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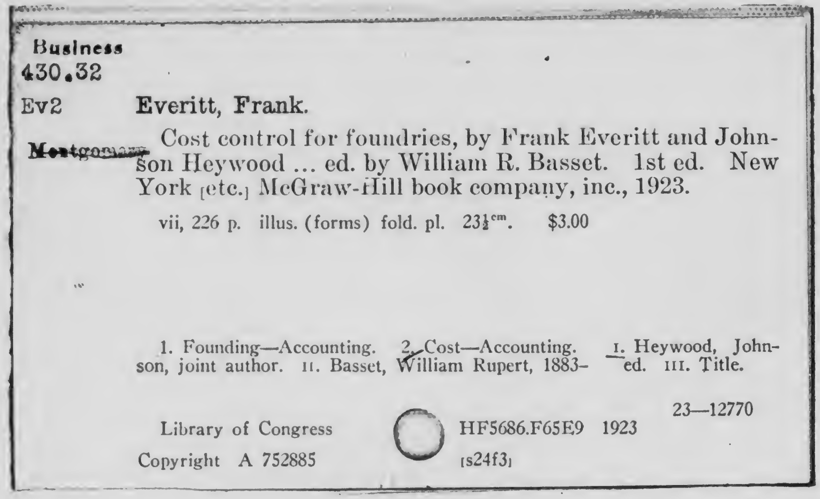

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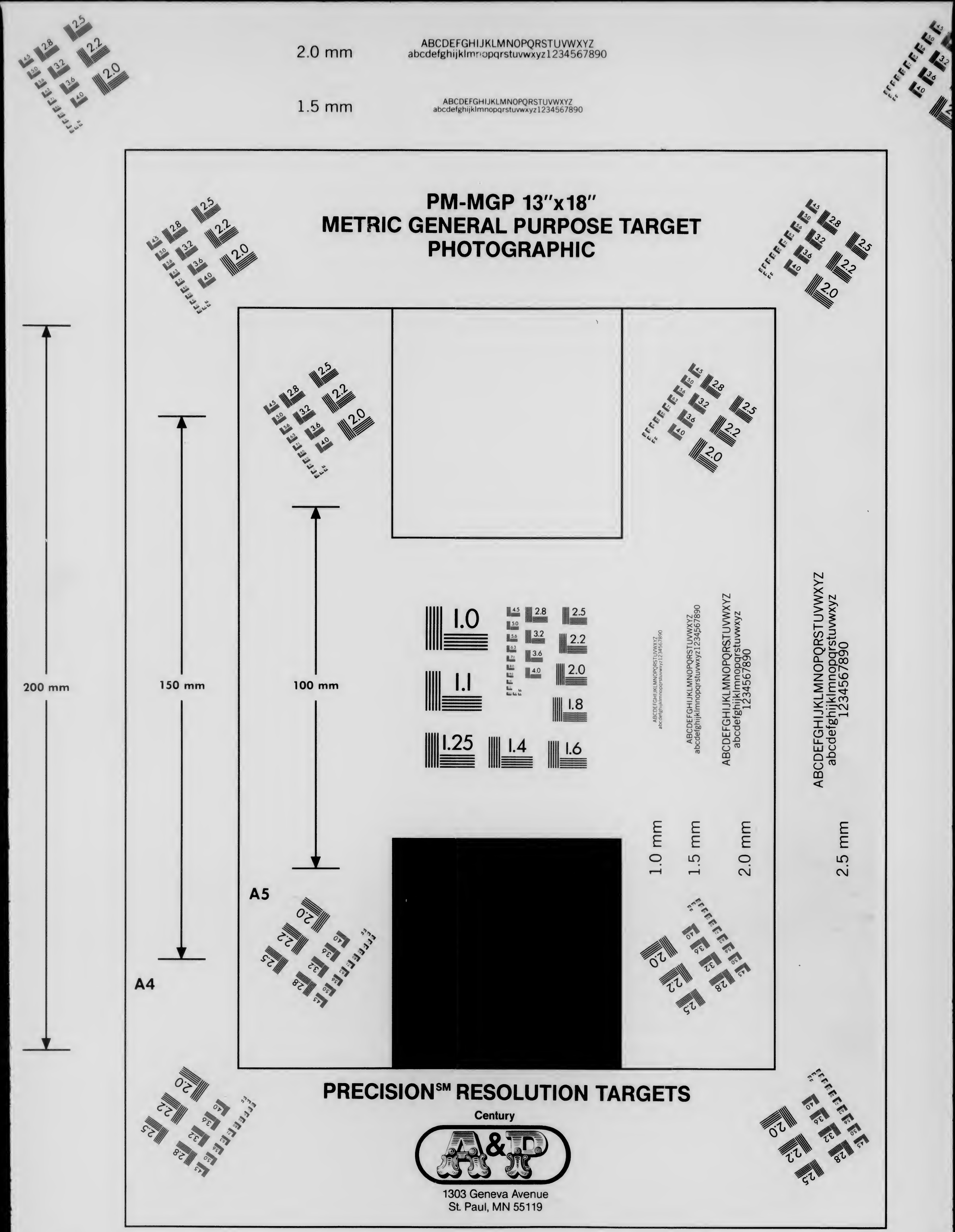

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COST CONTROL FOR FOUNDRIES

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COST CONTROL FOR FOUNDRIES

BY
FRANK EVERITT
AND
JOHNSON HEYWOOD
OF
Miller, Franklin, Basset & Company

EDITED BY
WILLIAM R. BASSET

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FOREWORD

This book describes in detail the entire theory, practice and routine of cost accounting for foundries, in a way which should make the subject easily understandable by the foundryman who lays no claim to accounting knowledge. The language used is the language of the shop, and special care has been taken to show how, after all, correct costing merely reflects manufacturing methods and problems.

The principles which underlie all foundry cost finding are explained, and, while the greatest attention is given to the problems of the grey iron foundry, all of the variations in method needed by makers of malleable castings, steel castings and non-ferrous castings are covered thoroughly.

The aim has been to describe a method which, while insisting primarily upon accuracy, is at the same time simple and inexpensive to operate. That this has been accomplished is proved by the fact that the number of journal entries required is less than one-third as many as is needed by any other costing method which has so far been devised for foundries.

The authors recommend that anyone planning to instal cost methods in a foundry first read every part of the book carefully and thoughtfully so that he will get a complete understanding of the principles involved. If the foundry in which it is proposed to install cost methods is large enough to support three or four clerks it will be best to install the system just as it stands, in order to get the best results.

For the smaller plant with a clerical force of only one or two, some of the forms can be eliminated. The various summaries, for instance, are needed by the concern having a great many items to enter. The foundry with only a few items to account for can readily get along without the summaries, for their purpose is after all to provide a way to reduce the effort of segregating the items. If but slight effort is required labor and complication will be saved by not using the summaries.

The forms that are absolutely essential to any foundry wanting accurate costs are given in the following list. How much to eliminate for any particular foundry will have to depend upon the judgment of the individual reader. If however, he has read and absorbed the principles, it is quite certain that his judgment will be good in deciding what to eliminate.

While a total of 91 forms is shown in the book, it must not be felt that such a large number must be maintained by any foundry. For one thing 28 are purely illustrative, such as charts of accounts and lists of journal entries.

The following forms are illustrative only:
Numbers, 1, 2, 6, 23, 24, 27, 28A, 32, 33, 34, 36, 37, 39, 40, 42, 43, 44, 45, 46, 51, 52, 55, 56, 64, 65, 66, 67 and 68.

The small foundry can get along with only the following absolutely essential forms: 3, 5, 8, 9, 10, 11, 13, 15, 18, 19, 22, 25, 26, 28, 30, 35, 37–1, 37–2, 37–3, 37–3*a*, 37–4, 37–5, 37–6, 37–7, 37–8, 37–8*a*, 37–9, 37–10, 37–11, 37–12, 37–13, 38, 48, 49, 37–14, 37–15, 53, 57, 62, 69, 70 and 71.

The following forms are well worth while but not essential. The individual can determine for himself whether any or all of them would be worth using in his particular business. The optional forms are:
Numbers 4, 7, 12, 14, 16, 17, 20, 21, 25–A, 29, 31, 41, 47, 50, 54, 58, 59, 60, 61, 63 and 72.

The authors wish to give full credit to the several members of the staff of Miller, Franklin, Basset & Company who gave freely out of their personal experience. Especially are the authors indebted to William R. Basset for his guidance and for the time he spent in editing the book.

FRANK EVERITT.
JOHNSON HEYWOOD.

NEW YORK, N. Y.
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COST CONTROL FOR FOUNDRIES

CHAPTER I

WHAT A COST SYSTEM CAN DO FOR YOU

Almost any foundryman will agree that some method of figuring costs is essential to the profitable management of his business. But he commonly feels that "costs are costs" and that any routine of book-keeping which his accountant tells him is a cost system is a satisfactory one, provided it is not so complicated that it entails paying wages to two or three extra clerks. The foundryman is usually a shop man, interested in but two things—manufacturing as inexpensively as possible and selling at a profit. When it comes to cost finding, he generally makes one of two mistakes. He fears that the whole subject is so complicated and mysterious that he cannot hope to understand it, or he assumes that it is as simple a matter as adding up on the back of an envelope all of the expenses of his business and dividing that sum by the tonnage of castings produced.

Costing is neither so simple and obvious as this, nor need it be so shrouded in mystery that the ordinary man—who is intelligent enough to run a foundry—cannot understand it. It is the aim of this book to describe a simple yet accurate system of foundry cost keeping in such way that the whys and wherefores of each step will be perfectly clear to any foundryman.

1. How Costs Are Used.—Originally, costs were considered valuable solely as a guide in setting selling prices. A good many men failed to be impressed by this need, for they said, rightly enough, that their prices were set not by cost figures but by their competitors. In times of stiff competition, prices have to be met, regardless of what the cost figures showed, in order to keep the plant in operation. In boom times, prices can be shoved up without reference to the cost of manufacture. Even though this condition does exist, cost figures have a very definite value as a guide to selling policies in that, properly developed, they will show the foundryman which of his products are most profitable and which are least so. Then, even though business conditions force him to sell the unprofitable as well as the profitable items, he can do so with definite knowledge as a basis rather than guess work. Knowing definitely the margin of profit of each line, he can intelligently push the profitable lines even though he must continue to sell the less profitable ones.

This is, however, one of the least important of the functions of a cost system. Properly designed cost methods can be used:

1. To show possible manufacturing betterments
2. As a gauge of shop efficiency
3. As a guide in purchasing materials
4. To control operating expenses
5. As a guide in handling labor
6. To determine what the foundry shall produce
7. To guide the designing department
8. As a guide in installing new equipment
9. To help get business in slack times
10. To set selling prices
11. For the psychological effect on executives.

How these results are obtained will become apparent from time to time as the cost methods are developed in later chapters. But a few examples from the actual experiences of foundries with excellent cost systems may be interesting.

2. Foretelling the Value of New Equipment.—In one foundry the demand for production brought a call for an additional crane. This new crane would have relieved the situation, but a study of the cost figures showed that the investment would greatly increase the cost of production. A little planning, with costs as the guide, relieved the congestion and the work was produced in the required time.

Adequate cost figures may be made to prophesy what effect proposed new equipment will have on economy of manufacturing. Take, for instance the case of a small foundry producing about 700 castings a day. It was desired to increase the production and at the same time make it possible for the men to increase their daily earnings. A new installation for continuous moulding and pouring was designed, based upon careful time study analysis. The cost of the installation was to be about $35,000.

By means of the cost system it was prophesied that the costs could be cut about 18 per cent. Actually, here is what the results were after the new installation got to running smoothly.

Average monthly increase in production	62.9 per cent
Average monthly wage increase for moulders	27 per cent
Average reduction in labor and expense cost	18.5 per cent
Present return on investment	60 per cent

To one not familiar with the almost uncanny possibilities of accurate cost methods, this close agreement between the actual savings and those forecast by the cost system may be surprising, but they are not uncommon. There can be no question of the value of such information when changes in method or equipment are contemplated.

3. Cost Figures Guide Policies.—In one foundry, the policy was to let the sales department sell what it could, or what it wanted to. The manufacturing end was always under the domination of the sales end. As a result, the foundry was forced to make what the sales department sold, which could not always be done advantageously.

For instance, the foundry often found itself oversold on certain kinds of castings with the result that some of them had to be made with expensive equipment, rather than with the standard equipment for that type. To the sales department, production of castings was all important and although the foundry man *knew* in his heart that using the expensive equipment ran up the cost, he could not prove it in dollars and cents.

When, finally, a simple cost system was adopted, he showed beyond doubt that the practice of using the special equipment for standard production made this type of product cost 23 per cent more than it sold for. Based on the cost figures, the sales department is now given quotas of each kind of casting which it may sell. In that way the foundry is kept in balance and it is always able to get production on the equipment best suited to the job.

In a later chapter, we will discuss the use of "normal and abnormal" costs which have several valuable uses, one of the most important of which is as a help in getting business in slack times. Everyone knows in a general way that it costs more to turn out a casting when the foundry is only half busy than it does when running full time. That is because each casting must carry a greater proportion of the overhead. And every business man realizes that it is better to get back the labor and material cost plus a *part* of the plant overhead than to shut down entirely and lose *all* of the overhead. So he quotes a price to get business which he *hopes* will absorb part of his overhead; but without modern costing methods he is going it blindfolded—he never *knows* but that he may be pyramiding his losses. A cost system may be designed to tell him just what he will lose or make by taking a given amount of business at a given price for any condition of activity from shut-down to overtime operation.

These instances give in slight measure an idea of the uses to which a cost system may be put. In the proper place, we shall give instances to show how cost systems do the eleven things listed on page 2.

4. Accuracy of Method is Essential.—Some men feel that cost systems are not worth while—are even untrustworthy—because, they say, they have seen cost figures lie. There is much more to getting correct costs than merely arithmetical accuracy. There are right and wrong ways to figure costs. Just because a clerk or accountant shows you a figure which he says is your "cost" on a certain casting, it does not necessarily follow that it is the true cost. Most errors in cost finding come from using methods which do not truly reflect the amount of work, material and usage of equipment properly chargeable to that casting.

Here is a simple case to make the point clear. Suppose you make two pieces, *A* and *B*. *A* is made on equipment which costs $2 an hour to operate; *B*, on equipment which costs only $1 an hour. Suppose each piece requires one hour. Now, if one piece of each is made and the overhead of both machines is lumped and spread evenly over the production, each piece would be charged with $1.50, while, to be correct, *A* should be charged with $2 and *B* with $1. In such a simple case the error is obvious; but that is what happens when the most common error of cost accounting is committed—that of lumping the total overhead for the plant as a whole and charging it to the product on some arbitrary basis.

It is not enough to charge all expenses of the business to the product and get it all back in the selling price. Correct costing demands that each casting carry *only* that part of the expense which is determined by the manufacturing conditions under which it is made.

5. Fallacy of a Cost per Pound.—A common fallacy of this sort consists in calculating a cost per pound in a foundry which makes both light and heavy castings. Here is how it works out:

A plain casting weighing one ton and costing $10 to mould cannot be compared on a per pound basis with a light, complicated, cored casting weighing 100 pounds and costing $3 to mould. Let us consider the cost of these two castings for metal and moulding only:

(*a*)	Casting 2,000 pounds	$0.02 equals	$40
	Moulding equals		10
	Total		$50
	2,000 pounds will give a cost of $0.025 per pound.		
(*b*)	Casting 100 pounds	$0.02 equals	$2
	Moulding equals		3
	Cores equal		1
	Total		$6
	100 pounds will give a cost of $0.06 per pound.		

To figure the cost of the entire production of a foundry on a cost per pound basis, where varying kinds of castings are made, is an obvious error. Correct costs under such conditions are impossible.

Another foundry made only uniform cast iron pipe. Here it might seem to be correct to consider the cost on a ton basis, but when the conditions under which the various sizes were made was given consideration and the cost determined on a basis of units per pit or pipe produced, there was a variation in the cost per ton of from five to eight dollars for labor and expense alone.

If occasionally it is necessary to make three-inch pipe in a four-inch flask, the labor and expense cost per pound for the three-inch pipe will be greater than for the four-inch pipe. In one pipe foundry it took an accurate system of cost finding to convince the owners of this fact, but when they did see the point, it resulted in radical changes of manufacturing and selling policies.

6. Comparing Plants Intelligently.—In another instance, a single owner operates three foundries, one producing light castings, the second heavy castings and the third a general jobbing line of castings. The cost per pound of castings produced is quite properly very different in each foundry, yet investigations are frequently undertaken to determine why the cost per pound is so much higher in one than in the other. The fact is that the cost per pound cannot be the same and no such comparison should be attempted; a point which is well understood by the foundry superintendents, but apparently not by those less practical men who are in general charge of the business. Such investigations, caused by ignorance or fallacious reasoning, do not make for good feeling in the organization.

In another plant, the cost per ton of castings during one period of one year was high compared with the cost per ton for a similar period of the previous year. This brought down a thoughtless reprimand for the superintendent, until analysis showed that the shop had been running only part time and the whole expense of operation had been applied against the limited production. This of course made the apparent cost per ton higher. A closer analysis revealed that those workmen who *did* work had produced more units per man at a lower cost per ton. It was not apparent until proper consideration was given to the ratio which production activity bears to normal and the correct distribution of expense made.

These are some of the wrong methods of costing that result in figures which are untrustworthy. It should be—but seems not to be—apparent that it is better to have no cost figures at all than incorrect ones, for in one case the man knows he is going it blindfold and so goes forward carefully, and in the other he goes confidently ahead, feeling he is right, although guided by utterly false information.

7. Engineering the Proper Basis.—Therefore, the first attribute of a good cost system is that it give correct figures. To do this, it must be designed to reflect the manufacturing problems and conditions. It is more a problem in engineering common-sense than in accounting. Of course, the accounting must be sound, but no amount of sound accounting will offset a system's failure to reflect manufacturing conditions.

That leads us to see that the principles of cost finding for all foundries will be the same, for in general, all foundries use the same principles in turning out castings. But each foundry differs somewhat from all others in its detail methods, layout and organization. This book lays down the fundamental principles of cost finding which apply to all foundries. Then each phase is discussed in all its lights to show how conditions peculiar to any branch or kind of foundry work will change the method of costing. The result is that if all foundries were to install cost systems closely following the principles and methods laid down here, they would all be figuring their cost on a "uniform" basis although the detail routine of no two might be alike. They would, however, be competing on an intelligent basis, for all would be including all elements of cost, applied to the items of their product in the correct proportions. That uniformity is the second attribute of a good cost system.

The third is simplicity. Judgment is needed to know how far it pays to carry accuracy. It is not good sense to calculate the labor cost on a $20 job to the thousandth part of a cent when it is reasonably certain that the time the workmen put in on the job was not reported within five cents of the actual.

8. How Detailed Shall the Costs Be?—How detailed the costs should be and how much in the way of reports the executives should get depends upon the ability and willingness of the executives to use these aids in managing their business. It does not pay to hire a $1,200 a year cost clerk if the figures he develops cannot possibly save or make for the company more than he costs. The cost system should be so simple that its cost of operation will be more than repaid. That means that a small foundry will have a system so simple that the present bookkeeper can handle it; others will profit by carrying the cost finding to the point where one or two clerks are needed; and others, of large size and diversified product, will find that it pays to carry their costing into considerable detail for the sake of the close contact it gives on operations amounting to thousands of dollars. But to whatever extent the cost finding is carried, red tape is unnecessary and to be avoided. Detailed and accurate costs do not of necessity involve complexity. Any cost system can be simple. If it is not—it is not a good cost system.

9. Tying the Costs to the Books.—To get correct costs, it is essential that the steps in cost finding be subject to frequent checks for accuracy. That is done by what is known as "tying them into the general books." After all, cost finding is simply a process of analyzing the expenditures and charges of a business, in the light of manufacturing methods, to show how much of these expenditures are chargeable to each process, operation and, ultimately, each casting. Since that is so, it is easy to tie up the costs with the general books of account. At the year's end, if the cost system is properly designed, it is possible to determine the profit or loss of the business both in the usual way by closing the books and from the cost figures by subtracting the cost of the product sold from the total selling price. The two figures should check with but little variation.

Another test of a good system is, "Does it give control of the business?" It should show fluctuations in the overhead expense of each department and indicate what caused the fluctuation, so that wrong conditions may be quickly rectified, or steps taken to make unusually good conditions the standard for the future. In the same way, deviations from the standard labor cost show which men and departments are most efficient and enable the management to check slumps in efficiency before heavy losses ensue.

10. The Attributes of a Good System.—Accuracy, uniformity, simplicity, adaptation to the need, frequent checks and control are, then, the six attributes of a good and serviceable cost system. They are entirely possible of attainment by any foundry; in fact, this book is written solely to give to the foundryman an understanding of costs which will enable him to understand the principles of sound costing methods as they apply to his business. Some readers will be able to supervise satisfactorily their assistants in installing the methods. The others will, at least, be able to judge of the soundness of methods which others may instal.

A word of warning seems needed for the benefit of the few readers who may become unduly enthusiastic over costs. Over-enthusiasm usually results in carrying cost finding so far that it becomes a burden to the business. The step from properly detailed records to red tape is not hard to take. Make the results from the cost system justify the expense.

And, having a good cost system in operation, do not make the common mistake of feeling that the costs—left to themselves—will manage the business. They are valuable guides but the object of business is not cost finding. Of themselves, costs will not make profits, but the man who intelligently uses them, will.

CHAPTER II

THE FUNDAMENTALS OF COSTS

He who feels that cost finding is too confused and abstruse for him to understand will find that the subject becomes easy and clear when he understands the fundamentals of it. Therefore, to the man who has now hazy knowledge of costs, this chapter may be the most important in the whole book, for it defines in a simple way the terms used and gives briefly a bird's-eye view of the entire procedure in such a way that the entire theory should become clear. Once a manufacturer understands the theory, the practical application as set down in the following chapters will be easy to understand.

11. The Terms Used Must Be Definite.—There is a loose use of terms which commonly makes for confusion in the mind of the layman who is trying to understand cost accounting, such as the interchangeable use of the terms "indirect" and "non-productive" to designate labor which is not directly and measurably applied to the finished product. Accountants delight to argue the merits of these terms; but after all there is little to choose between them. The thing is to agree to use one or the other and thoroughly to understand its meaning. Therefore, the best starting point is to define terms.

The final manufacturing cost of an article is made up of the cost for material, labor and expense.

12. What Is Material?—Material is any matter which goes into the product and which can be identified in the finished article. This includes such items as pig iron, scrap, any additional material such as bolts, which may be used in the machine shop or assemblies and so on. It is sometimes called "direct material."

Supplies include any matter which aids in the manufacture but is not apparent in the finished casting. They include oil, belting, brooms, and such like. Supplies are by some called "indirect" or "expense" materials.

Of course, in the absolute sense, both "material" and "supplies" are materials, but for the sake of brevity we divide them and define them as above.

13. Labor Cost.—Labor may reach the finished casting in two ways.

Direct or productive labor is that labor which can be charged to a certain casting. Moulders, core makers and others perform direct labor.

Indirect, which is the same as a non-productive labor, is that labor which is necessary to the conduct of any manufacturing business, but which cannot be measured in the individual casting. It includes such labor as flaskmen, pattern storage help, miscellaneous shop help, foremen, shop clerks and so on.

14. Expense or Overhead.—Expense, otherwise known as "burden" or "overhead" includes all items not chargeable as either material or labor, and is made up of such items as factory supplies, fuel, sand, maintenance, clerical help, miscellaneous labor, foremen, administrative expense, fixed charges and so on. Items of expense cannot be directly traced in the finished product. They are incurred to supervise, shelter, instruct, maintain and otherwise help the direct labor to make the product, and the sales department to sell it.

Expense may be classified in several ways. First, there is the big general division between "manufacturing expense" which aids production and "selling expense" which is incurred in the effort to sell the product. Other classifications of expense will be described later in this chapter. Right here it seems best to clear up a point about direct and indirect labor and material which causes much confusion because it is so seldom clearly explained.

This arises from the fact that labor and material which start as productive may end up in the final costs as non-productive.

Simply to look at a finished casting will not tell whether it is productive or non-productive. It is the use to which this casting is put which is the determining factor. If a casting produced by the productive labor in the foundry is a repair part for a flask, the material and productive labor becomes an expense cost. This cost would then become a credit to the Goods in Process Account and a debit to the Manufacturing Expense Account. In the same way, bolts which are used as productive material in the assembly room may be used to make repairs in the foundry, in which event they become an item of expense in general maintenance.

Another case is when the foundry makes its own machine equipment instead of purchasing it. These machines would likely be made with productive labor and material; but the cost is chargeable to assets, therefore it is a credit to the Goods in Process Account and a debit to the Machinery and Equipment Account.

In most foundries, especially the smaller ones, with a varied output, this shifting of productive labor and material constantly occurs. If it is not taken into account, the costs will be inaccurate—perhaps seriously so.

15. Correct Distribution of Labor.—It is therefore necessary to divide the worker's time correctly among the kinds of work performed. The time he puts in producing a casting which is to be sold must find its way into the Goods in Process Account. If he is on a repair job his time must be charged to the Manufacturing Expense Account. If he works on castings for a new machine for the shop, his time is charged into the Fixed Asset Account and ultimately appears on the equipment ledger as a part of the cost of this new machine.

This exemplifies the statement already made that an accurate knowledge of the processes of manufacturing is essential in operating a cost system, and that costing must be guided by manufacturing conditions.

When it is not easily apparent just how to get an item of cost correctly charged, some seek to dispose of it by throwing it into General Expense. As little as possible should be charged into expense, for all expense must ultimately be spread onto the product and, try as we will, that allocation cannot be 100 per cent correct. The aim should be, rather, to try constantly to charge more and more items of cost directly to the product. In that way lies the ultimately most correct costs. But this can be carried to extremes. If an item for the plant as a whole is small, it would be silly to contract a large amount of clerical expense for the sake of minute accuracy which is bound to be nullified elsewhere by a necessarily approximate allocation.

16. Three Kinds of Expense.—Let us now see how the manufacturing expense can be classified. It is of three kinds:

1. The charges direct to the productive manufacturing departments which do work upon the product, such charges being of such a character that they cannot be charged directly to the product: such as miscellaneous labor, supplies, etc. The amount of these charges as a whole will vary with the activity of the plant, going up when the plant is busy and down when slack.

2. There are also charges to the non-productive or contributory department which must in turn be distributed to the productive departments. These items will also vary with the plant activities but not as markedly as those items in the productive departments. Such expenses as those for executives' salaries, office expense, heat, light and power, stockroom, receiving room, shipping room and so on come under this classification.

3. Insurance, taxes and depreciation are the three items of expense which go to make up the fixed charges and do not vary except under very unusual conditions with the productive activity of the foundry. The causes for fluctuation in these items will be due to a change in insurance policies, additions to the buildings and equipment or an exceptional amount of overtime. As a rule, however, these items remain fairly constant and require changing but once a year or so.

17. A Bird's-eye View of a Cost System.—With these fundamentals in mind, it seems well to get a bird's-eye view of the process of gathering the cost of a casting. To do this we shall trace through the accounting steps.

All items of labor, material and expense can be charged in only two ways: to Goods in Process or Manufacturing Expense. That is, they are charged either direct and at once to the casting or to the expense of doing business, to be charged to the casting later.

The simple chart, Form 1, shows the following accounts which must appear on the ledger:

1. Pig and scrap iron
2. Fuel
3. Supplies
4. Payroll
5. Manufacturing Expense
6. Goods in Process
7. Cost of goods sold
8. Sales

The accounts are opened with an inventory. Materials and supplies are charged to Pig and Scrap, Fuel and Supplies as they are purchased. As manufacturing proceeds, it is necessary to account for all material, labor and expense used. Let us assume that during a month just closed, the reports show that $6,000 worth of pig and scrap have been used directly in the product. This must be credited to the Pig and Scrap account and charged as direct material to the Goods in Process account. (Note the indicating line on the chart.)

Three hundred and sixty-five dollars worth of fuel has been used. This is a supply and becomes a part of the expense of manufacturing, therefore the amount is credited to the Fuel account and debited to the Manufacturing Expense account. The supplies used are credited to the Supplies account and charged to Manufacturing Expense. If in the Supplies account are included such items as bolts and screws, any that were used on assemblies in the machine shop become direct materials and are therefore credited to the Supplies account and debited to the Goods in Process account. The chart shows that $1,360 goes to Expense and $740 to Goods in Process.

The entire manufacturing payroll for the month is $13,956, of which $7,550 (the direct labor) is credited to the Payroll account and debited to the Goods in Process account. The rest of the payroll, $6,406, is indirect labor, (administrative, clerical, supervision, miscellaneous labor,

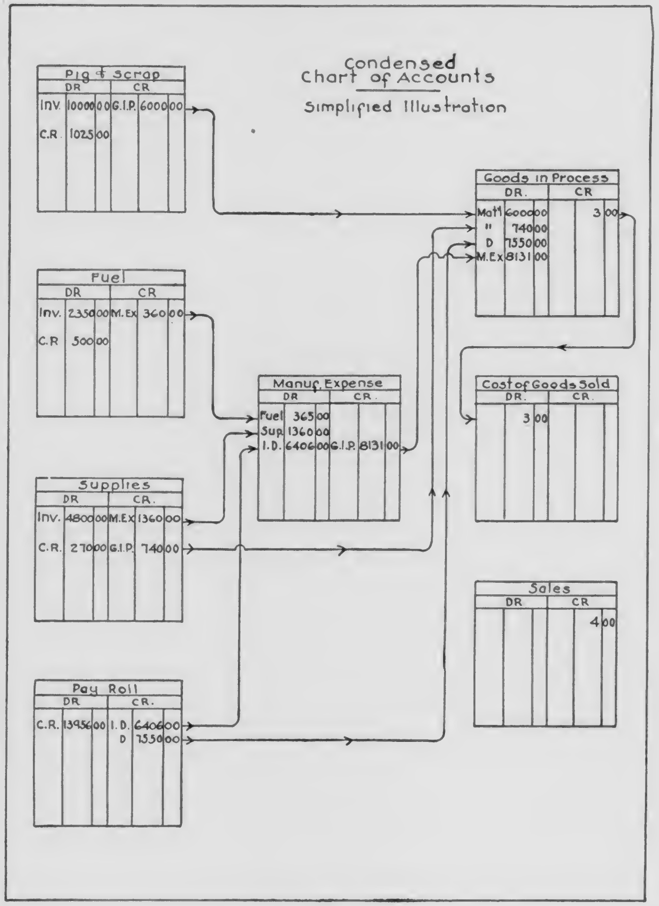


Fig. 1.

etc.) and is credited to the Payroll account and debited to the Manufacturing Expense account. This accounts for all of the material, labor and expense items for the month.

For simplicity, we assume that there is but one department in the foundry. The manufacturing expense, $8,131, must be spread to the product in some way. Let us say that for the single department of this plant the direct labor dollar is a fair measure of the expense which each item of product must bear. We find that the ratio which the expense bears to the direct labor is 107.9 per cent.

18. A Simple Explanation.—Since the direct labor cost of making castings was $7,550, it is necessary to add to that sum 107.9 per cent of that amount or $8,131, to cover the expense of doing business. The total direct labor and expense cost is $15,681.

There has already been charged to the Goods in Process accounts:

Material	$6,000
Material	740
Direct Labor	7,550
Total	$14,290

The $8,131 of expense is a part of the cost of production and therefore is credited to the Manufacturing Expense account and debited to the Goods in Process account.

Now if it is known that labor cost of a given casting is $0.96 and the material amounts to $1, the total cost of that casting is:

Material	$1.00
Labor	0.96
107.9 per cent Expense	1.04
Total	$3.00

Observe that the cost of this casting includes the three general divisions of disbursements—material, labor and expense; hence its basis is the same as that of the Goods in Process account into which all of these items have flowed. When this casting is sold, its cost of $3 becomes a credit to the Goods in Process account and a debit to the Cost of Goods Sold account. The selling price, say, $4, is a credit, giving a manufacturing profit of 25 per cent of the selling price, or 33⅓ per cent on the Cost of Goods Sold.

Having totaled the costs of all sales for the month and credited the Goods in Process account with this amount, the balance of this account gives the value of the Goods in Process inventory. Thus the total inventory from the accounts on the chart will be

1. Pig and Scrap account	$ 5,025
2. Fuel	2,485
3. Supplies	2,970
4. Goods in Process	22,418
Total Inventory	$32,898

This is a simple illustration of how the controlling accounts in the general books take care of the cost totals. We have determined the material, the labor and the basis of expense distribution. The cost of the individual casting is made up of identically the same items as the Goods in Process account.

In actual practice, of course, a foundry has many departments, for many of which the expense will be measured by other means than the labor dollar. The principle as outlined is however, fundamental and the process of tying the costs into the general books of accounts is identical.

19. The Chart of Accounts.—In the same way there will be more than the eight ledger accounts listed. The complete chart of accounts, Form 2, shows not only the general ledger accounts but the book forms for the original entries. It includes:

The charge register
Accounts Payable
The Inventory Accounts

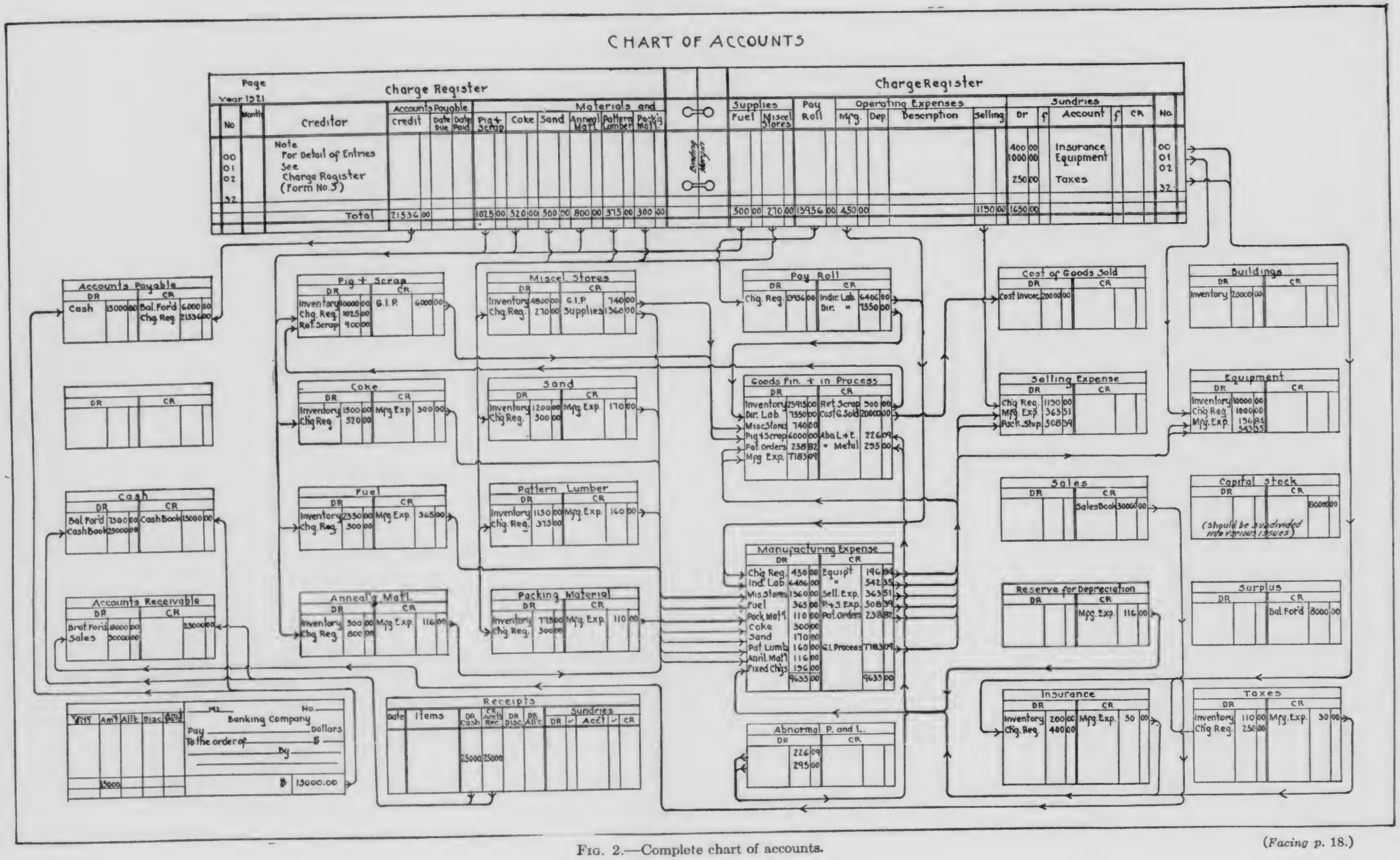


CHART OF ACCOUNTS
Charge Register
Page
Year 1921
No
Month
Creditor
Accounts Payable
Credit
Date Due
Date Paid
Materials and
Pig + Scrap
Coke
Sand
Anneal Mat'l
Pattern Lumber
Pack'g Mat'l
Binding Margin
Supplies
Fuel
Miscel Stores
Pay Roll
Operating Expenses
Mfg.
Dep.
Description
Selling
Sundries
Dr
Account
CR
No.
Note For Detail of Entries See Charge Register (Form No. 3)
00
01
02
32
400 00 Insurance
1000 00 Equipment
250 00 Taxes
Total 21536 00 1025 00 520 00 500 00 800 00 375 00 300 00
500 00 270 00 13956 00 450 00 1190 00 1650 00
Accounts Payable
DR Cash 15000 00
CR Bal. For'd 6000 00, Chg. Req. 21536 00
DR CR
Cash
DR Bal. For'd 7300 00, Cash Book 25000 00
CR Cash Book 15000 00
Accounts Receivable
DR Brot. For'd 8000 00, Sales 30000 00
CR 25000 00
Pig + Scrap
DR Inventory 10000 00, Chg. Req. 1025 00, Ret. Scrap 900 00
CR G.I.P. 6000 00
Coke
DR Inventory 1500 00, Chg Req 520 00
CR Mfg Exp 300 00
Fuel
DR Inventory 2350 00, Chg. Req. 500 00
CR Mfg. Exp. 365 00
Anneal'g Mat'l.
DR Inventory 300 00, Chg. Req. 800 00
CR Mfg Exp. 116 00
Miscel. Stores
DR Inventory 4800 00, Chg. Req. 270 00
CR G.I.P. 740 00, Supplies 1360 00
Sand
DR Inventory 1200 00, Chg Req. 500 00
CR Mfg Exp 170 00
Pattern Lumber
DR Inventory 1150 00, Chg. Req. 375 00
CR Mfg. Exp. 160 00
Packing Material
DR Inventory 7700 00, Chg. Req. 300 00
CR Mfg. Exp. 110 00
Pay Roll
DR Chg. Req. 13956 00
CR Indir. Lab. 6406 00, Dir. " 7550 00
Goods Fin. + in Process
DR Inventory 25915 00, Dir. Lab. 7550 00, Misc Stores 740 00, Pig + Scrap 6000 00, Pat. Orders 238 82, Mfg Exp. 7183 09
CR Ret. Scrap 900 00, Cost G. Sold 20000 00, Abn L. + E. 226 09, " Metal 295 00
Manufacturing Expense
DR Chg Req. 450 00, Ind. Lab. 6406 00, Mis. Stores 1360 00, Fuel 365 00, Pack. Mat'l 110 00, Coke 300 00, Sand 170 00, Pat Lumb 160 00, Anril. Mat'l 116 00, Fixed Chgs 196 00, 9633 00
CR Equipt 196 84, " 542 35, Sell. Exp. 363 51, P. + S. Exp. 508 39, Pat. Orders 238 82, G.I. Process 7183 09, 9633 00
Abnormal P. and L.
DR 226 09, 295 00
Cost of Goods Sold
DR Cost Invoic. 20000 00
Selling Expense
DR Chg Req. 1190 00, Mfg. Exp. 363 51, Pack. Ship. 508 39
Sales
CR Sales Book 30000 00
Reserve for Depreciation
CR Mfg. Exp. 116 00
Insurance
DR Inventory 200 00, Chg. Req. 400 00
CR Mfg. Exp. 50 00
Buildings
DR Inventory 20000 00
Equipment
DR Inventory 10000 00, Chg Req. 1000 00, Mfg. Exp. 196 84, 542 35
Capital stock
CR 30000 00
(should be subdivided into various issues)
Surplus
CR Bal. For'd 8000 00
Taxes
DR Inventory 110 00, Chg Req. 250 00
CR Mfg. Exp. 30 00
Y'M'T Bill
Am't
All't
Disc
Am't Paid
192
No.
Banking Company
Pay Dollars
To the order of $
By
15000
$ 15000.00
Receipts
Date
Items
DR Cash
CR Acct's Rec.
DR Disc
DR All'c
Sundries
DR
Acct
CR
25000 25000

FIG. 2.—Complete chart of accounts.

(*Facing p. 18.*)

The General Ledger accounts for
  Buildings
  Equipment
  Insurance
  Taxes
  Reserve for Depreciation
  Payroll
  Goods Finished and In Process
  Manufacturing Expense
  Selling Expense
  Cost of Goods Sold
  Sales
Accounts Receivable
Cash
Capital Stock, and
Surplus

Even this list of accounts is to serve only as an illustration in describing the general method, the control and the tying of the costs in with the general books.

For instance, only two asset accounts are shown, "Buildings" and "Equipment." The "Equipment" account in particular may be subdivided into "Machinery and Equipment," "Patterns and Flasks" and so on. The detail list of course will depend upon the requirements of each foundry.

This is but one of the many places where it will be seen that the exact method of cost finding to be used depends upon the peculiarities of the individual foundry; the principles being, however, uniform.

It seems ridiculous to set up a complicated method and then expect the various businesses to adapt themselves to it. Common sense dictates that the method, rather, be changed and adapted to suit the needs of the foundry. That is what this book attempts.

CHAPTER III

DEPARTMENTALIZING THE OVERHEAD EXPENSE

When foundrymen get together at conventions, the conversation is almost sure to turn at some time to overhead expense.

"Last year," says one, "my overhead was 153 per cent of the labor cost. How does that compare with yours?"

"It's low," is the reply, "mine was 194 per cent."

A third man interrupts with, "You fellows figure your overhead wrong. You should take it as a percentage of the labor plus the material. On that basis, my overhead runs 127 per cent."

And a fourth foundryman is apt to put in an objection to both methods and argue that overhead should be calculated in terms of cents per pound.

20. Comparing Cost Figures.—Obviously, no two of these methods can be intelligently compared to give an indication of the relative efficiencies of the plants, for in effect all of these men are speaking different languages. Even the first two, who use the same method, cannot make sure comparisons, for an overhead rate that is low for a jobbing foundry making diversified castings might be excessive in a plant making a standard line of pipe or radiators.

At bottom, the fallacy lies in considering the overhead expense of the business as a whole; a fault largely due to old-fashioned accountants who lumped all figures and were interested only to find out at the end of the year how much money the business as a whole had made or lost. Modern cost finding aims to discover not only "how much," but "why." To do that requires that the figures be divided and subdivided so that the manager may know, let us say, that the final profit of $100,000 represents a loss of $20,000 on one line and a profit of $120,000 on another. He wishes

also to know that the profit was made in spite of exceedingly inefficient methods in one manufacturing department which was more than offset by excellent methods in another.

Now, the overhead expense is in effect a service charge which each casting must pay for the manufacturing facilities which the business provides, and it should be plain that one casting will use more of some of these facilities than will another, while the other will use more of certain other facilities. For instance, a compact, heavy, simple casting will properly carry only a slight proportion of the moulding expense, although it may take a much larger share of the melting expense. A large, complicated but light casting will take more moulding expense and less melting expense. That makes it necessary, if the cost of each is to be known accurately, to charge each casting with its proper share of the overhead of each manufacturing department whose services it uses. To do that, the total overhead of each department must be gathered separately, and a way found by which to measure the proper share of each department's overhead or service which each casting should bear.

21. What Cost Departments Are.—All foundries are, for purposes of supervision, divided into several departments, such as pattern making, moulding and so forth. The departments as determined for costing purposes, will follow these divisions roughly, but not exactly. There will be some departments which would not be necessary for purely supervisory and operational purposes. The test for a department for cost purposes is: "Can the overhead expense of all operations in this department be justly applied on the same basis?" If not, further subdivision is necessary. It may be well to say here that what we speak of as a "department" is sometimes called a "production center." They mean the same.

The methods of applying the departmental expense may be different for each department; although sometimes two or more departments in the foundry may use the same measure. Each department must be studied carefully and the one best and most accurate measure determined, based, not upon accounting but upon manufacturing procedure. Each department must, in effect, be considered a factory in itself.

Several kinds of castings may be made on the moulding floor which require various types of equipment. For instance—bench moulding should not be charged with a part of the expense necessary to operate heavy machine moulding which requires constant crane service. The bench floor may perhaps be operated with an overhead of 75 per cent on the direct labor, while the heavy machine work with crane service may show an overhead of 200 per cent or be operated on the basis of expense per machine hour. If there are widely varying conditions due to the character of the work and the nature of the equipment, the moulding floor must be divided into several departments.

The proper departments can be set up only after a thorough investigation by men familiar both with foundry practice and cost finding principles.

There are engineering problems in the Power Plant, the Melting Department, Core Room, Moulding Floor, Cleaning Shop, Annealing Department and the Machine Shop, which must be studied in cooperation with the practical men in charge of these departments and in full recognition of their ability, knowledge and experience, before the details of the methods to be applied can be developed.

22. The System Must Fit Peculiar Conditions.—The methods to be used must fit the manufacturing conditions and processes of the individual plant and the accounts on the general books set up accordingly. It is true that a majority of the accounts are standard business practice; but some changes may be necessary to suit the conditions found as a result of the preliminary investigation.

In the same way the departmental division needed by individual foundries will vary with the practical considerations of the work done. Those needed by the foundry whose costing system we are describing in this book are fairly typical of what most foundries would require. They are:

No.	Department name	No.	Department name
1	Steam (Boiler)	9	Core Room
2	Power and Light	10	Moulding
3	Tool and Maintenance	11	Cleaning
4	Pattern Shop	12	Annealing
5	General Office	13	Machine Shop
6	General Factory	14	Packing and Shipping
7	General Foundry	15	Selling Expense
8	Melting		

In a gray iron foundry, the annealing department would be left out. We include it here because it presents some difficult problems which we must explain.

Other foundries might need such other departments as Carpenter Shop, Blacksmith, Electrical and so on. If the foundry is large enough to warrant further division, these departments may be set up to give the needed individual control. Care should be exercised, however, to avoid too detailed a division because of excess supervision and related expense.

In the foundry whose departments have been listed, the Pattern Shop will handle all carpentry, while the blacksmith, electricians, plumbers, millwrights, etc., are included in the Tool and Maintenance Departments. This combination is usual in medium-sized foundries, while in larger ones a division is usually necessary.

23. Special Shops Require Special Departments.—Again, in a stove and range plant, the Machine Shop would be replaced by the departments for Cast Iron Mounting, Sheet Metal Mounting, Pipe Cutting, Japanning, Nickeling, Punch Press and Forming and so on. In a plant where much testing is necessary, such as in the manufacture of radiators, boilers, etc., there would be such departments as First Test, Machining, Assembling, Second Test, Finishing, etc. In the malleable plant, the cleaning must be divided into Hard Iron Cleaning, Sand Blasting, Soft Iron Cleaning, Testing and Inspection, Straightening, etc.

A steel foundry would be divided into the same departments as the gray iron foundry although the detailed method of handling the melting department would be changed somewhat to suit the different method of melting.

For the electric steel foundry casting ingots, the core, moulding and cleaning departments would be omitted. The important departments to be added to the list are those for handling ingot moulds, pouring, and removing the ingots.

We wish to emphasize that the departments required depend on the plant, its size and the product. The list selected is, as stated, purely to illustrate the application of the method being described.

24. What Departmentalization Accomplishes.—The departments properly laid out are of great value in facilitating the determination of:

(*a*) The departmental floor space occupied, which may sometimes be used as a basis for distributing a portion of the fixed charges;

(*b*) The plant values, as a basis for ascertaining share of building depreciation and of taxes and insurance.

(*c*) The equipment values by departments, in order to ascertain the proper share of the depreciation of the plant equipment and of taxes and insurance on these.

Other reasons for departmentalizing the foundry are to get:

(*d*) More effective supervision.

(*e*) The distribution of the indirect, contributory or non-productive departments' expense to the productive departments.

(*f*) The control of departmental operating expense by months, periods and years.

(*g*) The basis for unit cost determination which is used in calculating the manufacturing cost of the product.

(*h*) The departmental normal expense, the minimum cost control, and so on.

25. How to Distribute Expense.—We have already stressed the point that the correct basis for distributing overhead expense must be determined for each department in every plant. Let us see from an example why this is an important factor in getting correct costs.

Suppose two foundries in one plant, both having exactly the same floor space. In one foundry the work is all hand moulding, with no machine or crane equipment. In the second foundry, the work may be all machine work requiring two overhead cranes.

In Case 1, it would be correct to distribute the expense on the basis of the productive labor dollar or the man hour.

In Case 2, it would be most accurate to figure the cost on a machine hour basis by gathering all of the expense necessary to operate each machine and reducing it to a cost per hour.

Let us now figure the cost of making a casting for both cases. Case 1. It is assumed that the expense rate per man hour is $0.80 and the time required to make the casting is one hour.

Time per casting..................	1 hour
Rate per hour, moulder.............	$0.80
Expense rate per hour..............	0.80
Total labor and expense cost each.	$1.60

Case 2. Five of these same castings can be made on the machine in one hour, the machine method having been introduced to reduce production costs.

Let us assume that the machine hour expense rate is $4.65 for all of the expenses.

Time for 5 castings................	1 hour
Machine rate per hour.............	$4.65
Direct moulding labor..............	1.75
Total labor and expense..........	$6.40
Cost each casting................	$1.28

These are the correct methods of figuring the costs.

Suppose now, however, that the two shops lump their overhead, and find that it is 150 per cent on the productive labor dollar. Of course, this is the wrong way—as we shall show.

The cost in Case 1 will be:

Direct moulding labor for casting.....	$0.80
Expense to labor 150 per cent........	1.20
Cost per casting..................	$2.00

This increases the apparent cost per casting by $0.40, because foundry No. 1 is made to carry a part of the burden of the other foundry, which it should not be compelled to do. This increase in cost may be prohibitive in meeting competition, with a resulting loss of business.

The cost in Case 2 will be:

Direct moulding labor per casting.....	$0.35
Expense to labor 150 per cent........	0.53
Cost per casting..................	$0.88

This makes the cost appear to be $0.40 per casting less than the real cost, because the expense of this foundry is carried by the first one.

In this case the cost of the casting would be too low, and in estimating, considerable unprofitable business may flow in as a result of the low price.

If this foundry, No. 2, should be filled with orders for say, 50,000 of this casting, an actual manufacturing loss would be incurred amounting to $20,000.

26. How Errors Creep in.—If none of these castings had been shipped at inventory time, the inventory would show 50,000 castings at $0.88 or $44,000. If, however, 10,000 of these castings had been made in Foundry 1 and the inventory figures at the estimated cost price, $0.88 each, which is not an infrequent occurrence, the inventory would have been the same, *i.e.*, $44,000. If figured from the actual cost, the amount would have been:

Foundry 1,	10,000 castings at $2.00 =	$20,000
Foundry 2,	40,000 castings at $0.88 =	35,200
Total Inventory		$55,200

If $0.88 is taken as a basis for the selling price, the manufacturing loss would have been $11,200. Had the cost been determined on the correct basis, the manufacturing cost estimate would have been $1.28 each and the inventory would have amounted to—

Foundry 1—10,000 castings at $1.60 =	$16,000
Foundry 2—40,000 castings at $1.28 =	51,200
Total Inventory	$67,200

With $1.28 each figured as manufacturing cost into the selling price, the manufacturing loss would have been only $3,200.

27. Two Fundamentals in Accounting.—These simple calculations prove—as no general arguments can—the two fundamentals of accounting for overhead expense, which it is positively essential that the reader realize:

First. Where a general overhead expense percentage is used for all departments, it is rare to find the costs tied in with the general books. If they are, it is of little value, by way of proof and a check on profits. It results in an over- or under-valuation of inventories.

Second. With proper cost methods, when a departmental expense analysis is operated, the figures which enter into the cost of manufacturing must first prove with the controlling accounts in the general ledger, before they can be distributed and the final departmental unit costs determined. This gives a reliable guide to where and how the castings should be made and the actually collected cost shows the actual profit by items, orders, processes and classifications of product. At the end of the period when the books are closed, the cost of manufacturing must again prove with the general books. If there is no proof through the controlling accounts in the general ledger, costs are of little value, because there is not a chance for actual knowledge of the business and the needed accuracy in the control of manufacturing and selling.

To the reader familiar with accounting, it will become apparent, as these pages are studied, that only one expense account—Manufacturing Expense—in the general ledger is necessary as far as manufacturing costs are concerned.

All the manufacturing expense is itemized and recorded by departments through the use of the Expense Analysis which will be described and shown in later chapters. The various items used in the expense analysis constitute, when taken together, a complete analysis of the controlling ledger account, Manufacturing Expense, thus relieving the accounting department through the elimination of the usual collection of ledger accounts and a long list of journal entries, while at the same time providing a more definite control of the business.

28. Two Kinds of Departments.—Looking back to the list of departments, it will be noticed that the departments naturally separate into two groups; the "productive" departments, which actually perform work on the castings being produced and the "non-productive" or contributory departments, which serve the productive departments directly on the foundry as a whole. In this typical foundry, the "productive" departments are the Melting, Coremaking, Moulding, Cleaning, Annealing and the Machine Shop; the contributory departments are Steam, Power and Light, Tool and Maintenance, Pattern Shop, General Office, General Factory, the General Foundry and the Packing and Shipping Department. There is another department under the heading of Selling Expense, but as the expense of this department has nothing to do with manufacturing costs, it will therefore be treated in a separate chapter.

In later chapters we shall study each of these departments in detail; to see just how the correct amount of expense for each is gathered and applied to the product

justly. An understanding of this question of expense and its departmentalizing is the most essential factor in working a cost system which will be accurate and of value in guiding the business.

CHAPTER IV

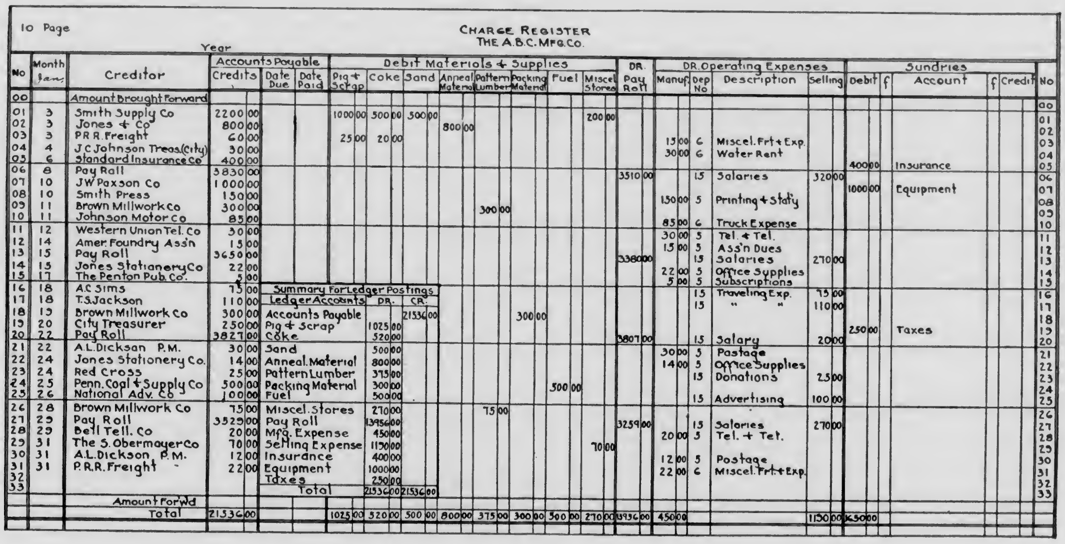
THE SOURCE OF THE ENTRIES

We saw in Chapter II that there are several kinds of items which make up overhead or expense.

It is apparent that some of these expense charges consist of actual expenditures of money, while a few, principally of the fixed charges in the third classification, are book entries.

The actual expenditures of money constitute by far the greater number of transactions and in the proper initial handling of them lies the possibility of greatly simplifying the bookkeeping and cost finding. They are introduced into the costs in the first place, through the charge register shown as Form 3. This form is a modern development which simplifies the bookkeeping transactions. The exact form which a charge register will take in any foundry will depend upon the peculiarities of the business. The divisions shown in Form 3 are quite sufficient to meet most needs, although some executives may desire a more detailed analysis of the inventory accounts. It will be noted that the three general divisions of manufacturing are provided for on the charge register, *i.e.*, material and supplies, labor, and expense with a fourth division for selling expense. Essentially, the charge register is simply a narrow channel through which all disbursements must pass.

29. Posting Expenditures to the General Books.—As invoices for purchases are received, they are entered on the charge register and distributed to the column under the proper account. At the end of the month, the totals of these columns are posted direct to the general ledger accounts. In the example shown the entries are:



10 Page

CHARGE REGISTER
THE A.B.C. MFG.CO.

Year

No	Month Jan.	Creditor	Accounts Payable			Debit Materials + Supplies								DR.	DR. Operating Expenses				Sundries					No
			Credits	Date Due	Date Paid	Pig + Scrap	Coke	Sand	Anneal Material	Pattern Lumber	Packing Material	Fuel	Miscel Stores	Pay Roll	Manuf.	Dep No	Description	Selling	Debit	f	Account	f	Credit	
00		Amount Brought Forward																						00
01	3	Smith Supply Co	2200 00			1000 00	500 00	500 00					200 00											01
02	3	Jones + Co	800 00						800 00															02
03	3	P R R. Freight	60 00			25 00	20 00								15 00	6	Miscel. Frt + Exp.							03
04	4	J C Johnson Treas.(City)	30 00												30 00	6	Water Rent							04
05	6	Standard Insurance Co	400 00																400 00		Insurance			05
06	8	Pay Roll	3830 00											3510 00		15	Salaries	320 00						06
07	10	J W Paxson Co	1000 00																1000 00		Equipment			07
08	10	Smith Press	150 00												150 00	5	Printing + Stat'y							08
09	11	Brown Millwork Co	300 00							300 00														09
10	11	Johnson Motor Co	85 00												85 00	6	Truck Expense							10
11	12	Western Union Tel. Co	30 00												30 00	5	Tel. + Tel.							11
12	14	Amer. Foundry Ass'n	15 00												15 00	5	Ass'n Dues							12
13	15	Pay Roll	3650 00											3380 00		15	Salaries	270 00						13
14	15	Jones Stationery Co	22 00												22 00	5	Office Supplies							14
15	17	The Penton Pub. Co.	5 00												5 00	5	Subscriptions							15
16	18	A.C Sims	75 00													15	Traveling Exp.	75 00						16
17	18	T.S. Jackson	110 00													15	" "	110 00						17
18	19	Brown Millwork Co	300 00								300 00													18
19	20	City Treasurer	250 00																250 00		Taxes			19
20	22	Pay Roll	3827 00											3807 00		15	Salary	20 00						20
21	22	A.L. Dickson P.M.	30 00												30 00	5	Postage							21
22	24	Jones Stationery Co.	14 00												14 00	5	Office Supplies							22
23	24	Red Cross	25 00													15	Donations	25 00						23
24	25	Penn. Coal + Supply Co	500 00									500 00												24
25	26	National Adv. Co	100 00													15	Advertising	100 00						25
26	28	Brown Millwork Co	75 00							75 00														26
27	29	Pay Roll	3529 00											3259 00		15	Salaries	270 00						27
28	29	Bell Tell. Co	20 00												20 00	5	Tel. + Tel.							28
29	31	The S. Obermayer Co	70 00										70 00											29
30	31	A.L. Dickson P.M.	12 00												12 00	5	Postage							30
31	31	P.R.R. Freight	22 00												22 00	6	Miscel. Frt. + Exp.							31
32																								32
33																								33
		Amount Forw'd																						
		Total	21536 00			1025 00	520 00	500 00	800 00	375 00	300 00	500 00	270 00	13956 00	450 00			1150 00	1650 00					

Summary for Ledger Postings

Ledger Accounts	DR.	CR.
Accounts Payable		21536 00
Pig + Scrap	1025 00	
Coke	520 00	
Sand	500 00	
Anneal. Material	800 00	
Pattern Lumber	375 00	
Packing Material	300 00	
Fuel	500 00	
Miscel. Stores	270 00	
Pay Roll	13956 00	
Mfg. Expense	450 00	
Selling Expense	1150 00	
Insurance	400 00	
Equipment	1000 00	
Taxes	250 00	
Total	21536 00	21536 00

FIG. 3.

Accounts Payable is credited with......... ... $21,536
Pig and Scrap is debited with........ $1,025
Coke is debited with.................. 520

and so on. The invoice is entered once and, at the end of the month, the totals give single entries to the Accounts Payable and Inventory Accounts. At the same time, the purchases are added to the book inventories and thus increase the value of Materials and Supplies on hand.

All entries for Payroll, Manufacturing Expense, Selling Expense and sundries become debits in total to their respective accounts with the exception of sundries. This set of columns is provided for entries such as additions to Buildings, Machinery and Equipment, payment of Insurances, Taxes, etc., each item of which is debited directly to its respective account. The chart of accounts shows all of these entries as they have been made from the charge register.

A point which is likely to create a little confusion is the purchasing of parts and supplies which may be needed for repair work. These parts may be distributed on the charge register under Manufacturing Expense and charged direct to the department needing the repaired parts. But uniformity in the method of accounting for the use of all materials and supplies is very desirable. Consequently, to avoid any errors in handling such parts or material after they have been received, it is well to charge them directly to the Miscellaneous Stores Account and account for the delivery to the department by the use of the requisition just as all other supplies are accounted for. The summary at the end of the month will give the classified use of all materials and supplies for credits to their respective inventory accounts. This summary of materials and supplies used will be described later in detail.

30. The Petty Cash Fund.—It is customary to make certain small purchases from a petty cash fund. Small as these amounts are, it is necessary to take account of them, if all items of cost are to be included. A petty cash voucher, Form 35, analyzes these expenditures readily, so that they can be entered upon the expense analysis of the department to which they belong. Such of the payments as are for materials are of course charged to the proper Inventory Accounts; for labor, to the Payroll account and so on. In fact, these cash expenditures ultimately get into the proper account in the general ledger in the same way as those which are entered in the charge register.

Fixed Charges.—Besides these expenditures, there are the charges for insurance and taxes which, with the depreciation, constitute the fixed charges.

Such fluctuations in these items as may develop will be due to changes in insurance policies, taxable values and rates and from depreciation varying through the changes in equipment and building values. Usually these changes are not sufficient to make it necessary to refigure the fixed charge sheet, Form 5, during the year for which it has been set up. It may suffice to make a monthly adjusting entry, but if these changes are marked a new fixed charge sheet should be prepared.

Insurance may be paid once a year or once in two or three years. An analysis of the past years' records of values and insurance carried, will provide a basis for predetermining the amount of insurance to be carried into the expense each month. It is an estimate, representing the average amount of premiums according to past experience, with consideration for expected developments.

The Insurance Account is debited with the premiums paid and credited monthly with one-twelfth of the yearly amount set up in the fixed charges. The monthly balance represents the cost of insurance premiums unexpired, that is, prepaid insurance.

31. Accounting for Taxes.—Taxes may be paid semi-annually or annually. The Tax Account is debited with the amount of the tax bills and credited monthly with one-twelfth of the amount set up in the fixed charges. Both taxes and insurance are distributed on the basis of actual net values. This refers to fire insurance and taxes on the plant only. Boiler insurance is a direct power charge, while liability insurance applies to the plant as a whole and should be charged to General Factory. Taxes on real estate and the plant are the only tax items chargeable to manufacturing. Franchise taxes are a general business expense while income tax is a direct deduction from profits.

Depreciation is merely a book entry, but it must find its way into the cost of production so that provision may be made to replace the buildings and equipment when they have served their useful life.

Incorrect charging of depreciation is a common serious defect in costing. The whole subject is too generally slighted and handled as a matter of convenience. It is by no means uncommon to find manufacturers charging off depreciation entirely from the standpoint of net profits. If the net earnings for the year are exceptionally good, an excess amount is written off, while in poor years little or no depreciation is charged. Fortunately, the Federal Income Tax rulings have forced manufacturers to be consistent in charging off depreciation.

To set arbitrarily a blanket rate for depreciation on buildings and another rate on machinery and equipment will give incorrect costs because both the Building and the Machinery and Equipment Accounts include both long and short-lived units.

32. Calculating Depreciation.—Buildings and equipment depreciate because of wear and tear from use, age, deterioration from physical causes, the change in market values due to inventions, inefficiency and inferiority of design and from obsolescence. The rate of depreciation for buildings should be determined by capable engineers based on the known life of various kinds of construction. For machinery and equipment, the rate will vary from 2 to 25 per cent or more, depending upon the type, its use and the conditions under which it operates. The cost of replacement, the forced sale value and the operating worth must be given consideration with the regulations from the Treasury Department governing.

The determination of values and the corresponding rates and amounts of depreciation present many intricate and involved problems which make desirable the services of the trained appraisal engineer.

Appraisals may be of several kinds, depending upon the purpose for which they are intended. The insurance appraisal differs in form and is treated differently from the appraisal prepared for depreciation and costs. Values from the standpoint of insurance are based upon the replacement or reproduction costs and this must include the freight and installation of the equipment as well as the cost of the equipment at point of purchase. From this cost, allowance must be made for depreciation accrued so that the sound values may be determined at the time the appraisal is made.

For cost purposes, it is essential to know with some fair degree of accuracy building, equipment and machinery values by departments so that the amounts of depreciation, taxes and insurance may be correctly distributed.

So far we have spoken of the depreciation of buildings, machinery and equipment, but the principles involved do not differ when applied to such equipment as patterns and flasks. The treatment of this equipment, however, is slightly different. The production department may issue authorized orders to make new patterns and new flasks. If these patterns and flasks are for some particular job outside of the plant, the charge is made to the customer in accordance with the contract or quotation, but if they are made as new patterns and equipment for a standard product, such as ranges, boilers, radiation etc., the cost of these becomes an addition to assets.

Instead of writing off an annual depreciation, this equipment may be carried at an inventory value. Obsolete patterns may be scrapped and new ones charged expense. The inventory must however increase with business expansion.

33. The Value of an Appraisal.—An inventory of the foundry buildings and equipment with recorded values is just as important as an inventory of material, supplies and goods in process. The ledger accounts show the values of all inventories in total with the physical inventory as a record with which to reconcile these figures. There are also asset values in the general ledger for buildings and equipment, but there is usually no detailed record of the buildings and equipment to show how these values have been built up.

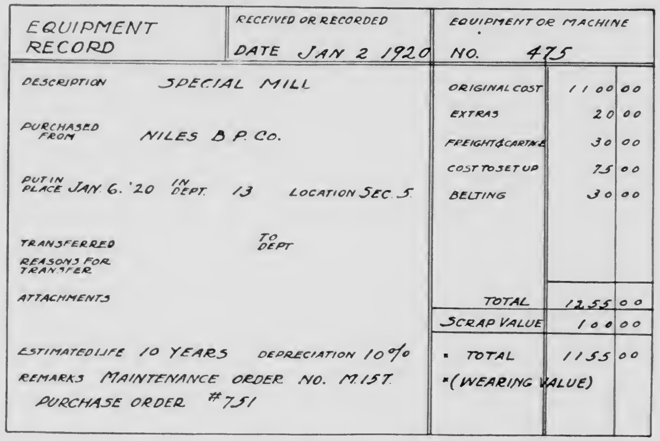
In many instances the purchase value of the machines only has been charged to assets with no account made of transportation charges, foundations or cost of setting up. These items should be included in the value of the machine set ready for production. The cost of the machine f.o.b. point of purchase by no means represents the total cost as the base for determining depreciation.

One concern which operated a foundry as one of its large departments recently erected a new building, for which the contract price was $20,000. This was the amount set up on the books. It was later learned that much of the labor and some material had been furnished by the company owning the building, but *this* cost had not been charged to assets. It was further learned that when any new machines were built by themselves or when any additions to buildings were made, the cost of them was considered as miscellaneous expense. Since the real assets were so badly understated, the amount of depreciation charged into the cost of the product was far from sufficient.

34. The Plant Ledger.—The plant ledger, which shows the detail of the asset accounts, should be of a form which will permit of a complete and accurate record. One similar to that shown on Forms 4 and 4A, will serve this purpose. This record provides for a complete cost and history of the unit as well as the record of repairs, depreciation written off monthly and the going value. The sum of the values on these record cards must, of course, check with the general ledger accounts.

On the fixed charge sheet, Form 5, are shown arbitrarily chosen figures merely for the purpose of illustration.

The sum of the amounts for insurance, taxes and depreciation constitute the fixed charges for the year. This sum is $2,360, of which one-twelfth is charged monthly into the

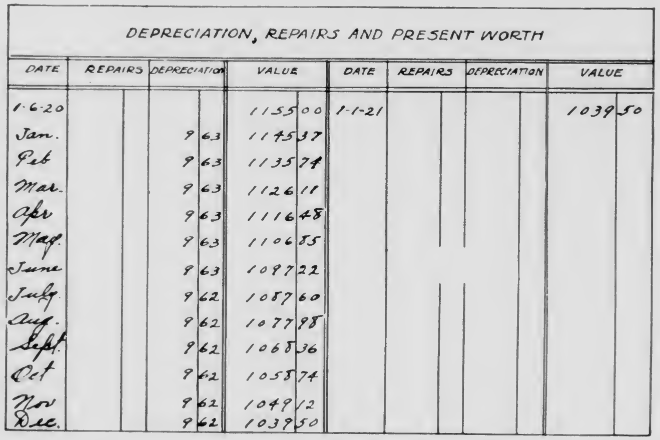


EQUIPMENT RECORD
RECEIVED OR RECORDED DATE JAN 2 1920
EQUIPMENT OR MACHINE NO. 475

DESCRIPTION SPECIAL MILL
PURCHASED FROM NILES B P. Co.
PUT IN PLACE JAN. 6. '20 IN DEPT. 13 LOCATION SEC. 5
TRANSFERRED TO DEPT
REASONS FOR TRANSFER
ATTACHMENTS
ESTIMATED LIFE 10 YEARS DEPRECIATION 10%
REMARKS MAINTENANCE ORDER NO. M.157.
PURCHASE ORDER #751

ORIGINAL COST	1100	00
EXTRAS	20	00
FREIGHT & CARTAGE	30	00
COST TO SET UP	75	00
BELTING	30	00
TOTAL	1255	00
SCRAP VALUE	100	00
* TOTAL	1155	00
*(WEARING VALUE)		

Fig. 4.



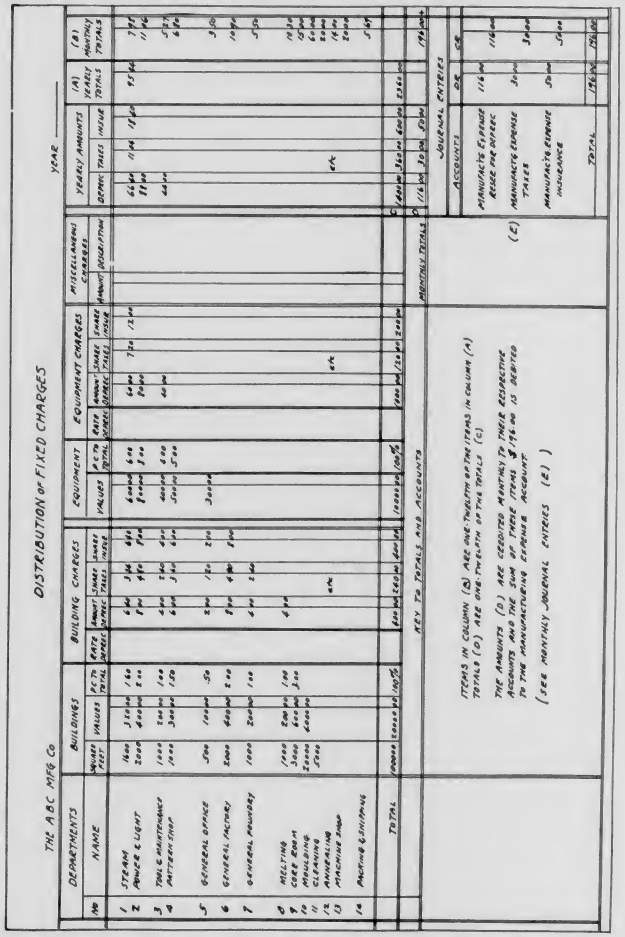
DEPRECIATION, REPAIRS AND PRESENT WORTH

DATE	REPAIRS		DEPRECIATION		VALUE		DATE	REPAIRS		DEPRECIATION		VALUE	
1-6-20					1155	00	1-1-21					1039	50
Jan.			9	63	1145	37							
Feb			9	63	1135	74							
Mar.			9	63	1126	11							
Apr			9	63	1116	48							
May.			9	63	1106	85							
June			9	63	1097	22							
July.			9	62	1087	60							
Aug.			9	62	1077	98							
Sept.			9	62	1068	36							
Oct			9	62	1058	74							
Nov			9	62	1049	12							
Dec.			9	62	1039	50							

Fig. 4A.

expense of doing business. But this monthly charge must be distributed correctly to the various departments and productive units.

The value of the buildings and the department's share of this value must check with the Asset Account in the general ledger. If several departments are set up in one building, it may be possible to divide the building value into departmental values on the basis of the floor space occupied. This does not always follow, and sometimes a just



THE ABC MFG Co

DISTRIBUTION OF FIXED CHARGES

YEAR ———

DEPARTMENTS		BUILDINGS			BUILDING CHARGES				EQUIPMENT		EQUIPMENT CHARGES				MISCELLANEOUS CHARGES			YEARLY AMOUNTS			(A) YEARLY TOTALS	(B) MONTHLY TOTALS
NO	NAME	SQUARE FEET	VALUES	PC TO TOTAL	RATE DEPREC	AMOUNT DEPREC	SHARE TAXES	SHARE INSUR	VALUES	PC TO TOTAL	RATE DEPREC	AMOUNT DEPREC	SHARE TAXES	SHARE INSUR	AMOUNT	DESCRIPTION		DEPREC	TAXES	INSUR		
1	STEAM	1600	3200 00	1 60		6 40	3 84	6 40	6000 00	6 00		60 00	7 20	12 00				66 40	11 04	18 40	95 84	7 98
2	POWER & LIGHT	2000	4000 00	2 00		8 00	4 80	8 00	8000 00	8 00		80 00						88 00				11 46
3	TOOL & MAINTENANCE	1000	2000 00	1 00		4 00	2 40	4 00	4000 00	4 00		40 00						44 00				5 27
4	PATTERN SHOP	1000	3000 00	1 50		6 00	3 60	6 00	5000 00	5 00												6 80
5	GENERAL OFFICE	500	1000 00	.50		2 00	1 20	2 00	3000 00													3 50
6	GENERAL FACTORY	2000	4000 00	2 00		8 00	4 80	8 00														10 70
7	GENERAL FOUNDRY	1000	2000 00	1 00		4 00	2 40															5 50
8	MELTING	1000	2000 00	1.00		4 00																10 30
9	CORE ROOM	3000	6000 00	3.00																		15 00
10	MOULDING	20000	4000 00																			60 00
11	CLEANING	5000																				20 00
12	ANNEALING						etc						etc						etc			14 00
13	MACHINE SHOP																					20 00
14	PACKING & SHIPPING																					5 69
	TOTAL	100000	20000 00	100%		400 00	240 00	400 00	10000 00	100%		1000 00	120 00	200 00			C	1400 00	360 00	600 00	2360 00	
	KEY TO TOTALS AND ACCOUNTS														MONTHLY TOTALS		D	116 00	30 00	50 00		196 00

ITEMS IN COLUMN (B) ARE ONE-TWELFTH OF THE ITEMS IN COLUMN (A)
TOTALS (D) ARE ONE-TWELFTH OF THE TOTALS (C)

THE AMOUNTS (D) ARE CREDITED MONTHLY TO THEIR RESPECTIVE ACCOUNTS AND THE SUM OF THESE ITEMS $196.00 IS DEBITED TO THE MANUFACTURING EXPENSE ACCOUNT

(SEE MONTHLY JOURNAL ENTRIES (E))

(E) JOURNAL ENTRIES

ACCOUNTS	DR	CR
MANUFACT'G EXPENSE RESER FOR DEPREC	116 00	116 00
MANUFACT'G EXPENSE TAXES	30 00	30 00
MANUFACT'G EXPENSE INSURANCE	50 00	50 00
TOTAL	196 00	196 00

FIG. 5.

division can only be made on the basis of the ratio of the cubic feet in a department to that of the entire building.

35. The Fixed Charge Sheet.—On the fixed charge sheet, the departments are listed in the first column. In the columns under "Buildings" are the square feet and departmental values. In the third column is the percentage which the departmental value bears to the total. Under "Building Charges" are the depreciation, taxes and insurance. The amount of depreciation is determined according to the rate applied. Taxes and insurance are determined on the basis of valuation, the respective totals being $240 and $400. To determine the departmental charges for taxes, the procedure is as follows:

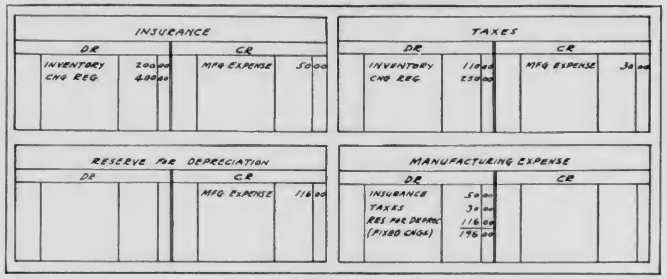
Steam..................	1.6 per cent of $240 =	$3.84
Power and Light.........	2.0 per cent of 240 =	4.80
Tool and Maintenance....	1.0 per cent of 240 =	2.40
Pattern Shop............	1.5 per cent of 240 =	3.60

and so on until the total, $240, has been distributed to all departments. To determine the departmental charges for insurance, we would proceed in like manner to distribute the total, $400.

In the next set of columns under "Equipment" are the values of departments and the departmental percentage to the total. The equipment values are of course actual, and in check with the inventory, appraisal and asset accounts. In the next set of columns, under "Equipment charges" are the depreciation, taxes and insurance. The depreciation is determined according to the rates applied against the departmental values and units. Taxes and insurance are determined on the basis of valuation and the same method as used for building charges is here applied, the difference being in the percentages used.

36. Spreading the Fixed Charges.—Having determined the amounts of depreciation, taxes and insurance for each department under buildings and equipment, the totals of each are collected in the three columns under "yearly totals" with the sum carried to column "A" as the yearly amount of fixed charges. Column "B," representing one-twelfth of these amounts, gives the monthly charge for all departments into the expense of doing business. The yearly total is $2,360 and the monthly amount in round figures is $196. The total "C" gives the yearly amounts of depreciation, taxes and insurance separately, while the items "D" give the monthly amounts which become credits to their respective accounts with the sum $196 a debit to the Manufacturing Expense account.

On the lower portion of the fixed charge sheet is the "key" to the totals and accounts. To the right, the monthly journal entries are given. These entries do not change from month to month and are carried along during the year until it is found necessary to refigure the fixed charges.



INSURANCE

DR			CR		
INVENTORY	200	00	MFG EXPENSE	50	00
CHG REG	400	00			

TAXES

DR			CR		
INVENTORY	110	00	MFG EXPENSE	30	00
CHG REG	250	00			

RESERVE FOR DEPRECIATION

DR			CR		
			MFG EXPENSE	116	00

MANUFACTURING EXPENSE

DR			CR		
INSURANCE	50	00			
TAXES	30	00			
RES FOR DEPREC	116	00			
(FIXED CHGS)	196	00			

FIG. 6.

The journal entry for depreciation is shown in total, $116. It may, in many instances, be advisable to divide this item into depreciation for building and depreciation for equipment, with a still further division as conditions may dictate.

The ledger accounts affected and the corresponding entries are shown in Form 6. The journal entries are taken from the fixed charge sheet.

‡
29
NOV
'51

CHAPTER V

ACCOUNTING FOR MATERIALS AND SUPPLIES

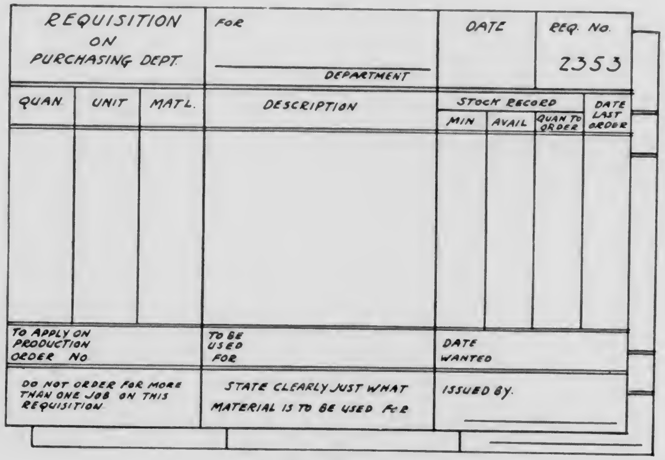
It is strange that manufacturers who guard and account for their cash as a matter of course, seem completely indifferent to what becomes of the materials for which that cash has been exchanged. If for no other reason than to prevent theft, good judgment demands that valuable stores be kept under lock and key in the custody of a trustworthy man.

This is especially necessary if an attempt is made to know costs, for unless control and a record of material usage is kept, no basis will exist for charging the right amount of materials to the finished product.

37. Common Sense in Cost Finding.—But good sense must dictate how far to go in keeping these records, or cumbersome red tape may be built up which costs more than the results are worth and which may even delay production. For instance, it is foolish to require requisitions for flour, core oil and compounds in order to account for the amount used per unit. The common-sense plan is to charge such small items direct to the expense of the department when purchased, to be applied to the product with the rest of the expense later. If there appears to be an excess use of such supplies, it will quickly show itself in the expense analysis.

The control of stores starts with their purchase, which is authorized on a requisition similar to Form 7.

The purchasing office orders from the vendor on a purchase order, Form 8, which also provides for the receiving and purchase office records. When the material is received, the receiving department reports it on Form 9. To report the receipt of several items to apply on several purchase orders, Form 10 will be found better,



REQUISITION ON PURCHASING DEPT.

FOR
DEPARTMENT

DATE

REQ. NO. 2353

QUAN | UNIT | MAT'L. | DESCRIPTION | STOCK RECORD: MIN | AVAIL | QUAN TO ORDER | DATE LAST ORDER

TO APPLY ON PRODUCTION ORDER NO

TO BE USED FOR

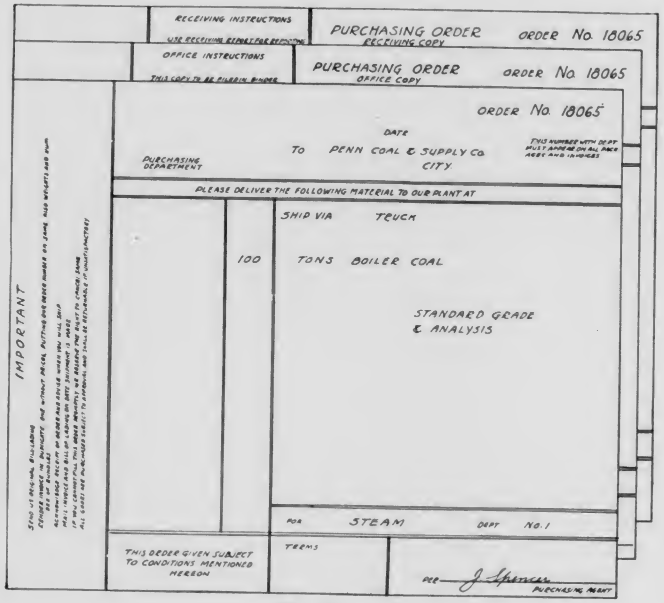
DATE WANTED

DO NOT ORDER FOR MORE THAN ONE JOB ON THIS REQUISITION

STATE CLEARLY JUST WHAT MATERIAL IS TO BE USED FOR

ISSUED BY.

FIG. 7.



RECEIVING INSTRUCTIONS
USE RECEIVING REPORT FOR REPORTING

PURCHASING ORDER
RECEIVING COPY
ORDER No. 18065

OFFICE INSTRUCTIONS
THIS COPY TO BE FILED IN BINDER

PURCHASING ORDER
OFFICE COPY
ORDER No. 18065

ORDER No. 18065

DATE

PURCHASING DEPARTMENT

TO PENN COAL & SUPPLY CO.
CITY.

THIS NUMBER WITH DEPT MUST APPEAR ON ALL PACKAGES AND INVOICES

PLEASE DELIVER THE FOLLOWING MATERIAL TO OUR PLANT AT

SHIP VIA TRUCK

100 TONS BOILER COAL

STANDARD GRADE
& ANALYSIS

FOR STEAM DEPT NO. 1

TERMS

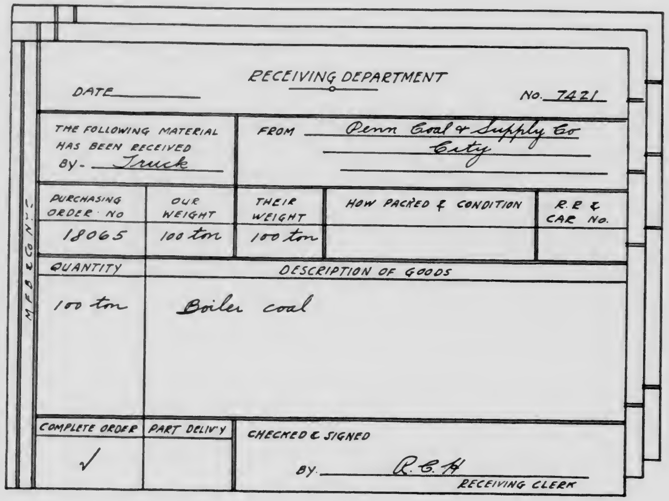
PER J. Spencer
PURCHASING AGENT

THIS ORDER GIVEN SUBJECT TO CONDITIONS MENTIONED HEREON

IMPORTANT

SEND US ORIGINAL BILL-LADING
RENDER INVOICE IN DUPLICATE ONE WITHOUT PRICES, PUTTING OUR ORDER NUMBER ON SAME ALSO WEIGHTS AND NUMBER OF BUNDLES
ACKNOWLEDGE RECEIPT OF ORDER AND ADVISE WHEN YOU WILL SHIP
MAIL INVOICE AND BILL OF LADING ON DATE SHIPMENT IS MADE
IF YOU CANNOT FILL THIS ORDER PROMPTLY WE RESERVE THE RIGHT TO CANCEL SAME
ALL GOODS ARE PURCHASED SUBJECT TO APPROVAL AND SHALL BE RETURNABLE IF UNSATISFACTORY

FIG. 8.



RECEIVING DEPARTMENT

DATE

No. 7421

THE FOLLOWING MATERIAL HAS BEEN RECEIVED BY- Truck

FROM Penn Coal & Supply Co
City

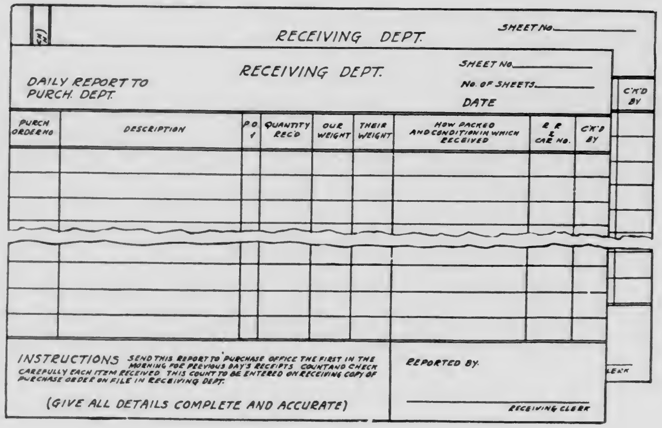
PURCHASING ORDER NO	OUR WEIGHT	THEIR WEIGHT	HOW PACKED & CONDITION	R.R. & CAR No.
18065	100 ton	100 ton		

QUANTITY	DESCRIPTION OF GOODS
100 ton	Boiler coal

COMPLETE ORDER	PART DELIV'Y	CHECKED & SIGNED
✓		BY R.C.H. RECEIVING CLERK

M F B & CO N Y C

FIG. 9.



RECEIVING DEPT. SHEET NO.

RECEIVING DEPT.

DAILY REPORT TO PURCH. DEPT.

SHEET NO.
NO. OF SHEETS.
DATE

C'K'D BY

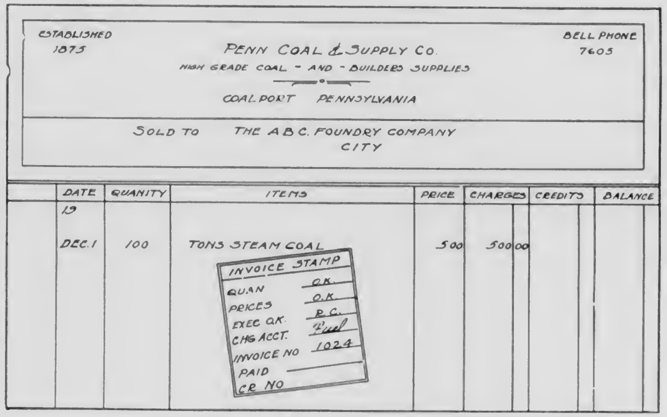
PURCH ORDER NO	DESCRIPTION	P.O. ✓	QUANTITY REC'D	OUR WEIGHT	THEIR WEIGHT	HOW PACKED AND CONDITION IN WHICH RECEIVED	R.R. & CAR NO.	C'K'D BY

INSTRUCTIONS SEND THIS REPORT TO PURCHASE OFFICE THE FIRST IN THE MORNING FOR PREVIOUS DAY'S RECEIPTS. COUNT AND CHECK CAREFULLY EACH ITEM RECEIVED. THIS COUNT TO BE ENTERED ON RECEIVING COPY OF PURCHASE ORDER ON FILE IN RECEIVING DEPT.

(GIVE ALL DETAILS COMPLETE AND ACCURATE)

REPORTED BY.
RECEIVING CLERK

FIG. 10.



ESTABLISHED
1875

PENN COAL & SUPPLY CO.
HIGH GRADE COAL - AND - BUILDERS SUPPLIES
COALPORT PENNSYLVANIA

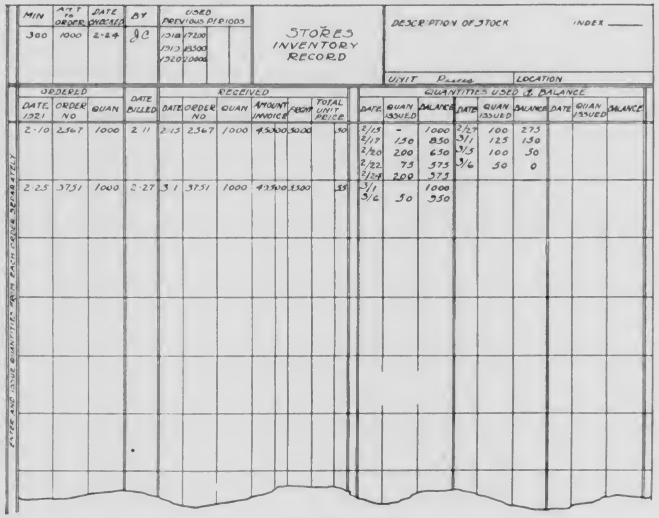
BELL PHONE
7605

SOLD TO THE A B C. FOUNDRY COMPANY
CITY

	DATE	QUANITY	ITEMS	PRICE	CHARGES	CREDITS	BALANCE
	19						
	DEC. 1	100	TONS STEAM COAL	5 00	500 00		

INVOICE STAMP
QUAN O.K.
PRICES O.K.
EXEC. O.K. R.C.
CHG ACCT. Fuel
INVOICE NO 1024
PAID
CR NO

FIG. 11.



MIN	AM'T TO ORDER	DATE CHECKED	BY	USED PREVIOUS PERIODS	
300	1000	2-24	JC	1918	17200
				1919	13500
				1920	20000

STORES INVENTORY RECORD

DESCRIPTION OF STOCK INDEX ______

UNIT Pieces LOCATION

ENTER AND ISSUE QUANTITIES FROM EACH ORDER SEPARATELY

ORDERED			DATE BILLED	RECEIVED						QUANTITIES USED & BALANCE								
DATE 1921	ORDER NO	QUAN		DATE	ORDER NO	QUAN	AMOUNT INVOICE	FRGHT	TOTAL UNIT PRICE	DATE	QUAN ISSUED	BALANCE	DATE	QUAN ISSUED	BALANCE	DATE	QUAN ISSUED	BALANCE
2-10	2567	1000	2 11	2 15	2567	1000	450 00	50 00	.50	2/15	-	1000	2/27	100	275			
										2/17	150	850	3/1	125	150			
										2/20	200	650	3/5	100	50			
										2/22	75	575	3/6	50	0			
										2/24	200	375						
2.25	3751	1000	2.27	3 1	3751	1000	495 00	55 00	.55	3/1		1000						
										3/6	50	950						

FIG. 12.

When the invoice, Form 11, is received, it is stamped, checked, approved and entered in the charge register. Since the one shown was entered on page 10, line 24 (see Form 3) it is given an invoice number 1024 to show the page and line by which it can be located quickly on the charge register, should need arise.

To gain the necessary control in accounting for materials and supplies, a record similar to the stores inventory, Form 12, is needed.

The entries in the "ordered" columns are actuated by the purchase requisition. The entries in the "received" column are made from the receiving report and invoice. Under the columns "quantities issued" and "balance," entries are made from the collected requisitions and reports which have been issued during the month.

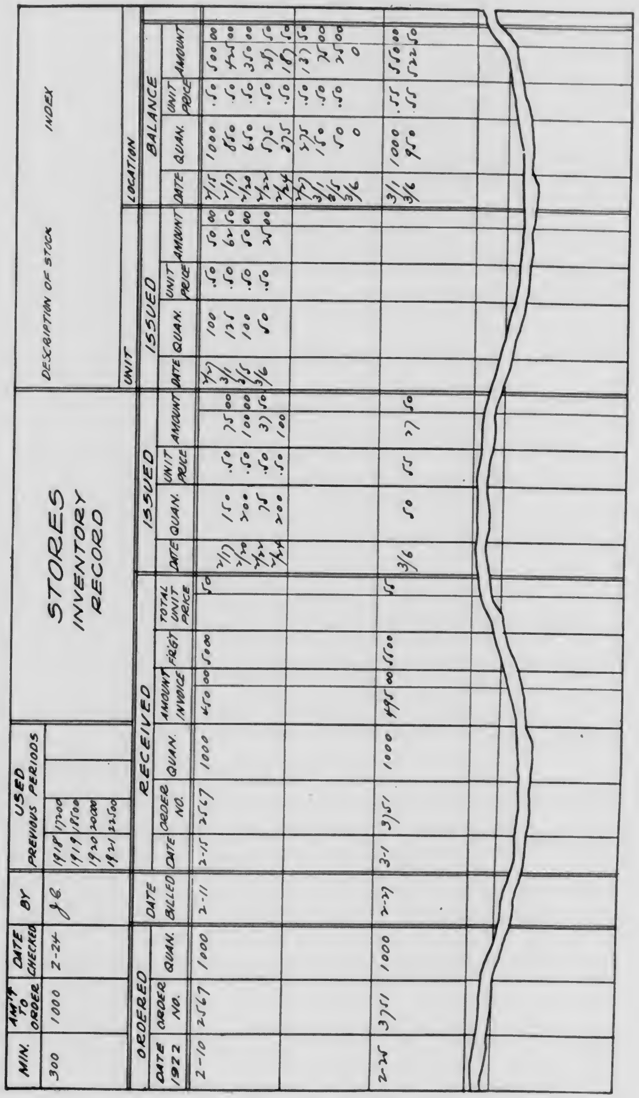
To insure accuracy, the quantities shown on this record must be checked frequently by physical count. These checks should be made when the stock falls to the minimum, as it then requires less time and effort. With a complete checking of the stores several times during the year, it is safe to take the physical inventory from the stock record.

38. The Inventory Record.—The inventory should be listed and priced from the stores inventory record, Form 12, then extended in order to determine the values. Form 12 shows the balance of stores in quantities only. If it seems desirable to show the values as well, Form 12A may be used. Such an inventory record is, in effect, a detail of the controlling ledger account.

The storekeeper is authorized to issue materials and supplies on a requisition form which is both an order on the stores department and a receipt. It also shows for what the materials or supplies are to be used and the department which is to be charged with them.

The expense requisition Form 13 carries the large letter "E" which enables it to be quickly distinguished from the requisitions for productive materials.

Note that the various uses to which the supplies may be put are printed on the requisition, and it is only necessary



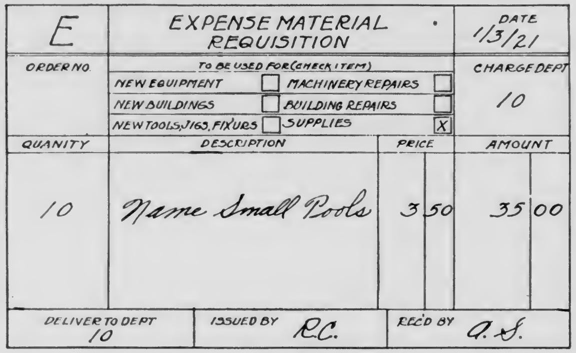
STORES INVENTORY RECORD

MIN.	AMT TO ORDER	DATE CHECKED	BY	USED PREVIOUS PERIODS	DESCRIPTION OF STOCK	UNIT	LOCATION	INDEX
300	1000	2-24	J.B.	1918 17200 1919 18500 1920 20000 1921 22500				

ORDERED				RECEIVED						ISSUED				ISSUED				BALANCE			
DATE 1922	ORDER NO.	QUAN.	DATE BILLED	DATE	ORDER NO.	QUAN.	AMOUNT INVOICE	FRGT	TOTAL UNIT PRICE	DATE	QUAN.	UNIT PRICE	AMOUNT	DATE	QUAN.	UNIT PRICE	AMOUNT	DATE	QUAN.	UNIT PRICE	AMOUNT
2-10	2567	1000	2-11	2-15	2567	1000	450 00	50 00	.50					2/27	100	.50	50 00	2/15	1000	.50	500 00
										2/17	150	.50	75 00	3/1	125	.50	62 50	2/17	850	.50	425 00
										2/20	200	.50	100 00	3/5	100	.50	50 00	2/20	650	.50	325 00
										2/22	75	.50	37 50	3/6	50	.50	25 00	2/22	575	.50	287 50
										2/24	200	.50	100					2/24	375	.50	187 50
																		2/27	275	.50	137 50
																		3/1	150	.50	75 00
																		3/5	50	.50	25 00
																		3/6	0		0
2-25	3751	1000	2-27	3-1	3751	1000	495 00	55 00	.55	3/6	50	.55	27 50					3/1	1000	.55	550 00
																		3/6	950	.55	522 50

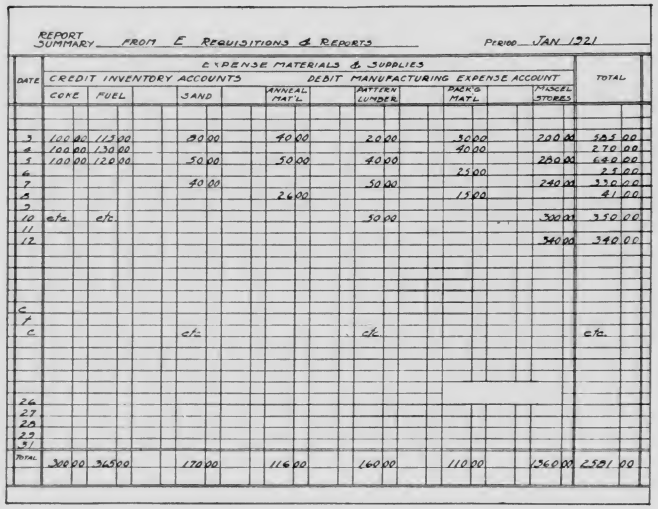
FIG. 12A.

to check the proper one. It is found that this saves considerable time for the cost department in allocating the cost later on, by preventing inaccurate accounting.



E	EXPENSE MATERIAL REQUISITION		DATE 1/3/21
ORDER NO.	TO BE USED FOR (CHECK ITEM) NEW EQUIPMENT ☐ MACHINERY REPAIRS ☐ NEW BUILDINGS ☐ BUILDING REPAIRS ☐ NEW TOOLS, JIGS, FIXURS ☐ SUPPLIES ☒		CHARGE DEPT 10
QUANITY	DESCRIPTION	PRICE	AMOUNT
10	Name Small Tools	3 50	35 00
DELIVER TO DEPT 10	ISSUED BY R.C.		REC'D BY A.S.

FIG. 13.



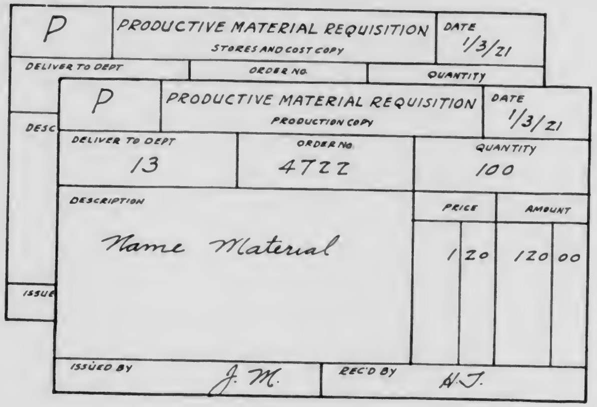
REPORT SUMMARY FROM E REQUISITIONS & REPORTS PERIOD JAN 1921

DATE	EXPENSE MATERIALS & SUPPLIES												TOTAL
	CREDIT INVENTORY ACCOUNTS						DEBIT MANUFACTURING EXPENSE ACCOUNT						
	COKE	FUEL		SAND		ANNEAL MAT'L		PATTERN LUMBER		PACK'G MAT'L		MISCEL STORES	
3	100 00	115 00		80 00		40 00		20 00		30 00		200 00	585 00
4	100 00	130 00								40 00			270 00
5	100 00	120 00		50 00		50 00		40 00				280 00	640 00
6										25 00			25 00
7				40 00				50 00				240 00	330 00
8						26 00				15 00			41 00
9													
10	etc.	etc.						50 00				300 00	350 00
11													
12												340 00	340 00
e													
t													
c				etc.				etc.					etc.
26													
27													
28													
29													
31													
TOTAL	300 00	365 00		170 00		116 00		160 00		110 00		1360 00	2581 00

FIG. 14.

If care is used in specifying just who has the authority to issue expense requisitions, a prolific source of waste will be eliminated.

It is well to have all requisitions reported to the cost department the first thing each morning for the previous day's deliveries. The clerk in the cost department enters withdrawals in the issued columns of Form 12, prices, and extends the requisitions. The tickets are then collected by inventory accounts and at once entered on the report summary, Form 14, for the day on which they were used. At the end of the month the totals are credited to their respective inventory accounts and debited to the Manufacturing Expense Account. These items and amounts appear on the journal sheet which is prepared monthly in the cost department.



P
PRODUCTIVE MATERIAL REQUISITION
STORES AND COST COPY
DATE 1/3/21
DELIVER TO DEPT
ORDER NO.
QUANTITY
DESC
ISSUE

P
PRODUCTIVE MATERIAL REQUISITION
PRODUCTION COPY
DATE 1/3/21

DELIVER TO DEPT	ORDER NO.	QUANTITY
13	4722	100

DESCRIPTION	PRICE		AMOUNT	
Name Material	1	20	120	00

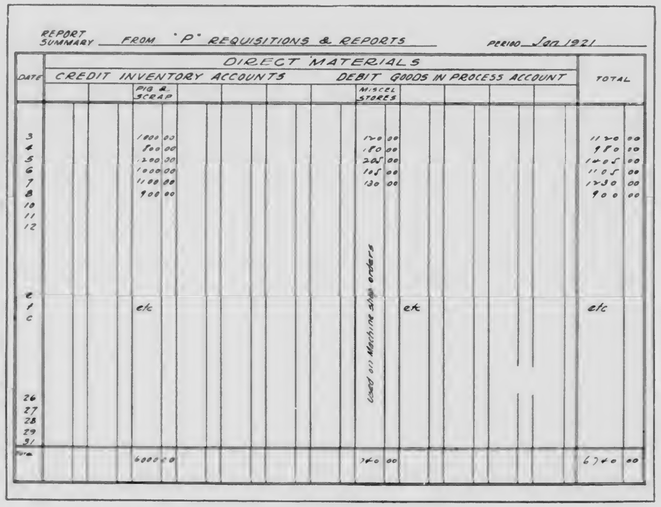
ISSUED BY J. M.
REC'D BY H.J.

Fig. 15.

39. More Uses of the Inventory Record.—Aside from purely costing purposes, the stores inventory record is of value as a control which shows:

1. The lowest point to which stock may be allowed to drop
2. The amount to order so that no shortages may develop
3. The amount used per year
4. Whether or not there is stock on hand which is slow moving
5. The maximum quantity to keep on hand and so on.

Requisitions for productive materials are made out on Form 15 and are accounted for in the same way as the expense requisitions. The extensions of these requisitions are collected and posted daily to the report summary sheet, Form 16, after which they are filled to facilitate

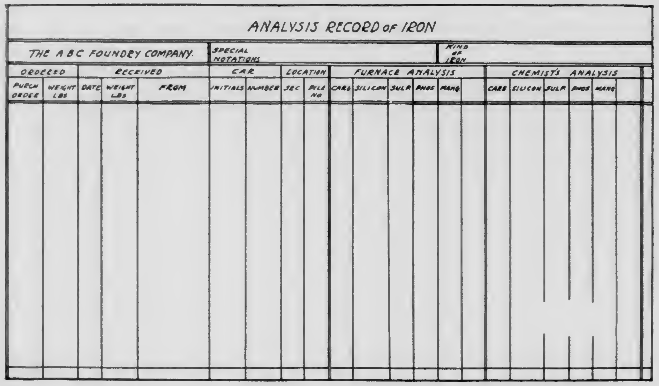


REPORT SUMMARY FROM "P" REQUISITIONS & REPORTS
PERIOD Jan 1921

DIRECT MATERIALS
CREDIT INVENTORY ACCOUNTS DEBIT GOODS IN PROCESS ACCOUNT

DATE			PIG & SCRAP				MISCEL STORES					TOTAL
3			1000 00				120 00					1120 00
4			800 00				180 00					980 00
5			1200 00				205 00					1405 00
6			1000 00				105 00					1105 00
7			1100 00				130 00					1230 00
8			900 00									900 00
10												
11												
12												
e t c			etc				Used on Machine shop orders	etc				etc
26												
27												
28												
29												
31												
Total			6000 00				740 00					6740 00

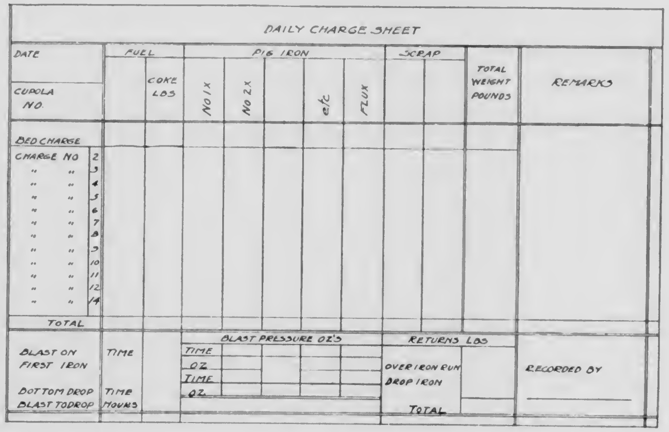
Fig. 16.



ANALYSIS RECORD OF IRON
THE A B C FOUNDRY COMPANY.
SPECIAL NOTATIONS
KIND OF IRON

ORDERED		RECEIVED			CAR		LOCATION		FURNACE ANALYSIS						CHEMIST'S ANALYSIS						
PURCH ORDER	WEIGHT LBS	DATE	WEIGHT LBS	FROM	INITIALS	NUMBER	SEC	PILE NO	CARB	SILICON	SULP	PHOS	MANG		CARB	SILICON	SULP	PHOS	MANG		

Fig. 17.



DAILY CHARGE SHEET

DATE / CUPOLA NO.	FUEL		PIG IRON					SCRAP		TOTAL WEIGHT POUNDS	REMARKS
		COKE LBS	NO 1X	NO 2X		etc	FLUX				
BED CHARGE											
CHARGE NO 2											
" " 3											
" " 4											
" " 5											
" " 6											
" " 7											
" " 8											
" " 9											
" " 10											
" " 11											
" " 12											
" " 14											
TOTAL											

BLAST ON FIRST IRON — TIME

BOTTOM DROP BLAST TODROP — TIME HOURS

BLAST PRESSURE OZ'S

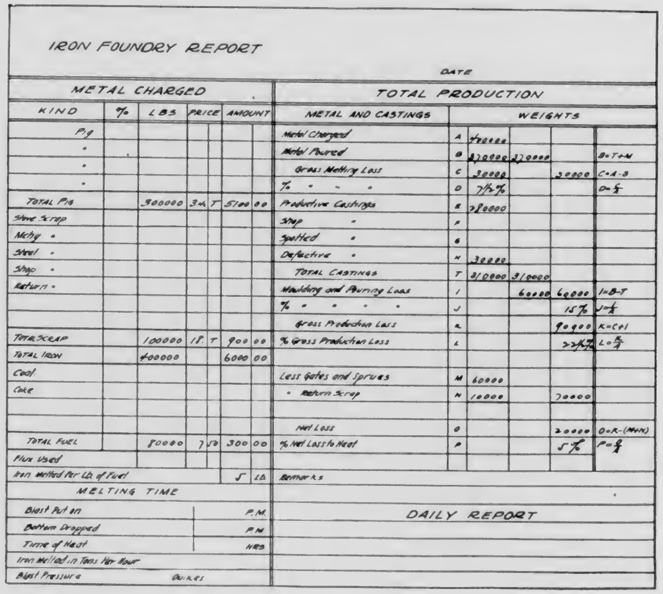
TIME				
OZ				
TIME				
OZ				

RETURNS LBS

OVER IRON RUN	
DROP IRON	
TOTAL	

RECORDED BY ____________

FIG. 18.



IRON FOUNDRY REPORT

DATE

METAL CHARGED

KIND	%	LBS	PRICE		AMOUNT	
Pig						
"						
"						
"						
TOTAL PIG		300000	34	T	5100	00
Stove Scrap						
Mchy "						
Steel "						
Shop "						
Return "						
TOTAL SCRAP		100000	18.	T	900	00
TOTAL IRON		400000			6000	00
Coal						
Coke						
TOTAL FUEL		80000	7	50	300	00
Flux Used						
Iron Melted Per Lb. of Fuel					5	Lb.

MELTING TIME

Blast Put on		P.M.
Bottom Dropped		P.M.
Time of Heat		HRS
Iron Melted in Tons Per Hour		
Blast Pressure	Ounces	

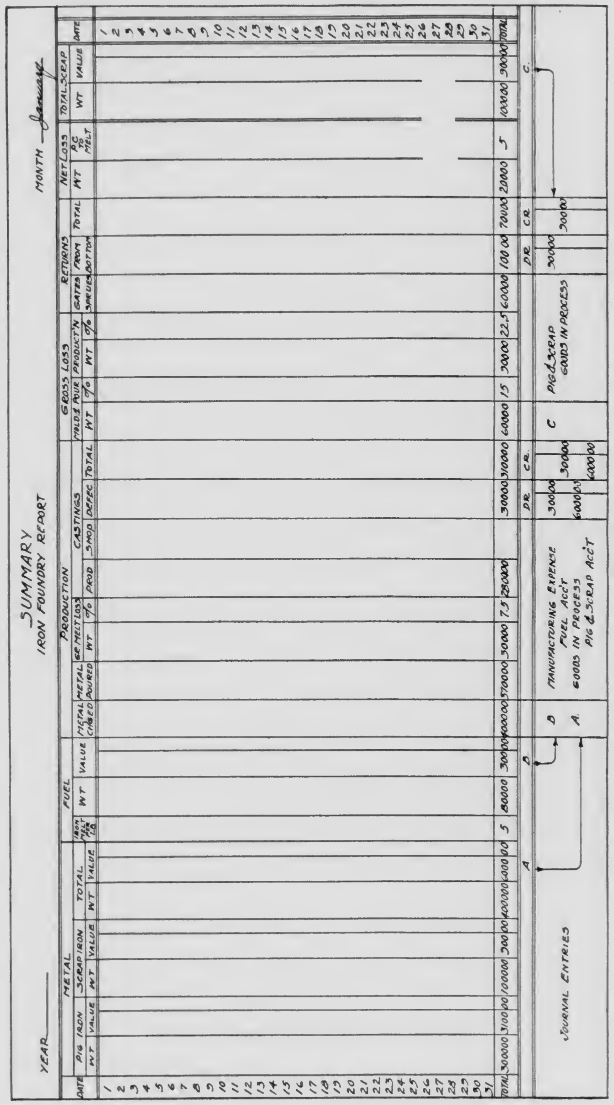
TOTAL PRODUCTION

METAL AND CASTINGS		WEIGHTS			
Metal Charged	A	400000			
Metal Poured	B	370000	370000		B=T+N
Gross Melting Loss	C	30000		30000	C=A-B
% " "	D	7½%			$D=\frac{C}{A}$
Productive Castings	E	280000			
Shop "	F				
Spotted "	G				
Defective "	H	30000			
TOTAL CASTINGS	T	310000	310000		
Moulding and Pouring Loss	I		60000	60000	I=B-T
% " " " "	J			15%	$J=\frac{I}{A}$
Gross Production Loss	K			90000	K=C+I
% Gross Production Loss	L			22½%	$L=\frac{K}{A}$
Less Gates and Sprues	M	60000			
" Return Scrap	N	10000		70000	
Net Loss	O			20000	O=K-(M+N)
% Net Loss to Heat	P			5%	$P=\frac{O}{A}$

Remarks

DAILY REPORT

FIG. 19.



SUMMARY
IRON FOUNDRY REPORT

YEAR ________ MONTH January

	METAL						FUEL			PRODUCTION								GROSS LOSS				RETURNS			NET LOSS		TOTAL SCRAP		
	PIG IRON		SCRAP IRON		TOTAL							GR MELT LOSS			CASTINGS			MOLDS POUR		PRODUCT'N									
DATE	WT	VALUE	WT	VALUE	WT	VALUE	IRON MELT PER LB	WT	VALUE	METAL CH'GED	METAL POURED	WT	%	PROD	SHOP	DEFEC	TOTAL	WT	%	WT	%	GATES SPRUES	FROM BOTTOM	TOTAL	WT	PC TO MELT	WT	VALUE	DATE
1																													1
2																													2
3																													3
4																													4
5																													5
6																													6
7																													7
8																													8
9																													9
10																													10
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29																													29
30																													30
31																													31
TOTAL	300000	3100 00	100000	900 00	400000	6000 00	5	80000	300 00	400000	370000	30000	7.5	280000		30000	310000	60000	15	30000	22.5	60000	10000	70000	20000	5	100000	900 00	TOTAL
						A			D							DR	CR						DR	CR				C.	

JOURNAL ENTRIES

		DR	CR
D	MANUFACTURING EXPENSE	300 00	
	FUEL ACC'T		300 00
A.	GOODS IN PROCESS	6000 00	
	PIG & SCRAP ACC'T		6000 00
C	PIG & SCRAP	300 00	
	GOODS IN PROCESS		300 00

FIG. 20.

collecting the final cost. At the end of the month the totals from the summary, Form 14, also appear on the journal sheet for final posting to the general ledger.

The pig iron, scrap, fuel and flux are reported, not on requisitions, but on special report forms, which will be discussed in Chapter IX.

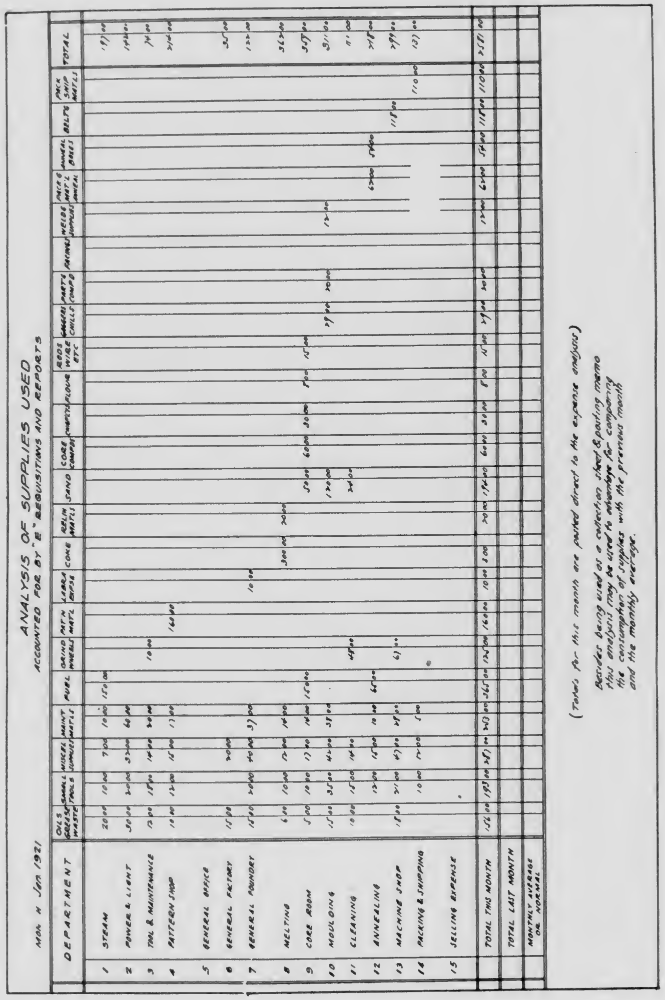
The use of the analysis record of all irons, Form 17, needs no explanation.

A form which is essential to the well-managed foundry is the charge sheet, Form 18, from which is secured the amount of metal, fuel, flux and over iron, for each heat. These weights are posted to the iron foundry daily report, Form 19.

The material and supplies on this report are also posted daily to the summary sheets, Forms 14 and 16, and the totals, at the end of the month journalized to the general ledger accounts. How all of the entries are made and the standing of the ledger accounts for materials and supplies are shown at the end of this chapter, Forms 23 and 24.

On the summary of the daily foundry report, Form 20, daily postings are made of the melting and production results. This form is of value in watching the daily fluctuations of heats and the resulting production in total castings. The journal entries for the month have been incorporated, although this is not essential, because the summary Form 14 and 16 provide for this. These forms also provide a proof of accuracy in the accounting for melting material and supplies, and the total production.

40. Checking the Use of Supplies.—After the expense requisitions have been used to collect the amounts for posting by the accounting department, they are sorted by departments and kinds of supplies and so filed daily until the end of the month. The amounts are then collected and analyzed on the analysis of supplies sheet, Form 21, in convenient form for proof and posting to the expense analysis sheets. The make-up of the form is self-evident. Note that the total, $2,581, should check with the total shown on Form 14,



MONTH Jan 1921

ANALYSIS OF SUPPLIES USED

ACCOUNTED FOR BY "E" REQUISITIONS AND REPORTS

	DEPARTMENT	OILS GREASE WASTE	SMALL TOOLS	MISCEL SUPPLIES	MAINT MAT'LS	FUEL	GRIND WHEELS	PAT'N MAT'L	LABRA EXPSE	COKE	RELIN MAT'LS	SAND	CORE COMPDS	CHAPLETS	FLOUR	RODS WIRE ETC	GAGGERS CHILLS	PART'G COMP'D	FACINGS	WELD'G SUPPLIES	PACK'G MAT'L ANNEAL	ANNEAL BOXES	BELTS	PACK SHIP MAT'LS	TOTAL
1	STEAM	20.00	10.00	7.00	10.00	150.00																			197.00
2	POWER & LIGHT	30.00	20.00	32.00	60.00																				142.00
3	TOOL & MAINTENANCE	12.00	18.00	14.00	20.00		10.00																		74.00
4	PATTERN SHOP	10.00	12.00	15.00	17.00			160.00																	214.00
5	GENERAL OFFICE																								
6	GENERAL FACTORY	15.00		20.00																					35.00
7	GENERAL FOUNDRY	15.00	20.00	40.00	37.00				10.00																122.00
8	MELTING	6.00	10.00	12.00	14.00					300.00	20.00														362.00
9	CORE ROOM	5.00	10.00	17.00	14.00	150.00						50.00	60.00	30.00	8.00	15.00									359.00
10	MOULDING	15.00	35.00	42.00	38.00							120.00					29.00	20.00		12.00					311.00
11	CLEANING	10.00	15.00	14.00			48.00					24.00													111.00
12	ANNEALING		12.00	15.00	10.00	65.00															62.00	54.00			218.00
13	MACHINE SHOP	18.00	21.00	47.00	28.00		67.00																118.00		299.00
14	PACKING & SHIPPING		10.00	12.00	5.00																			110.00	137.00
15	SELLING EXPENSE																								
	TOTAL THIS MONTH	156.00	193.00	287.00	253.00	365.00	125.00	160.00	10.00	300	20.00	194.00	60.00	30.00	8.00	15.00	29.00	20.00		12.00	62.00	54.00	118.00	110.00	2581.00
	TOTAL LAST MONTH																								
	MONTHLY AVERAGE OR NORMAL																								

(Totals for this month are posted direct to the expense analysis)

Besides being used as a collection sheet & posting memo this analysis may be used to advantage for comparing the consumption of supplies with the previous month and the monthly average.

FIG. 21.

With this proof we are ready to make the postings in the expense analysis of the departments where the supplies have been used. These postings will be referred to again and further discussed in the chapters on the expense analysis.

The supplies analysis sheet, Form 21, serves another valuable purpose in that it shows the amount of each kind of supplies used in the whole plant for the month. For instance, the item of "oils, grease and waste." There is a charge for these supplies in nearly every department of the plant and the total consumption for the month amounts to $156. Similarly for "small tools," maintenance materials, etc. The form also shows the total of all supplies for each department, and provides for a comparison of the usage from month to month.

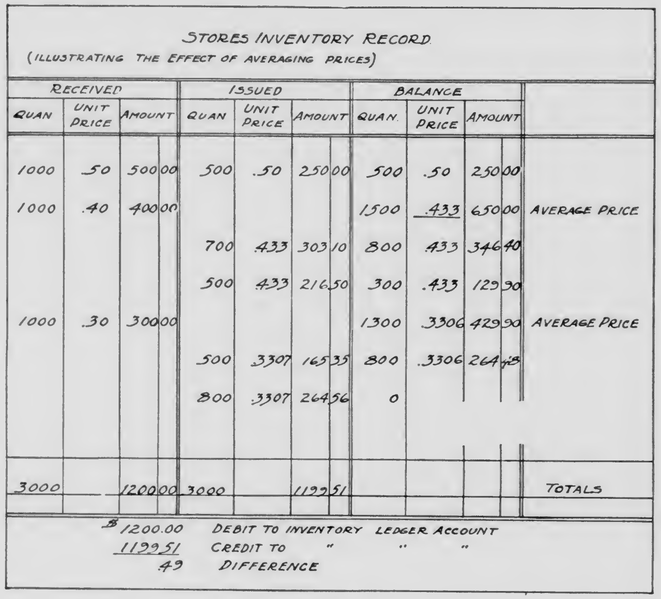
41. Pricing Out the Materials.—If the market price of materials remained constant, there would be no difficulty in correctly pricing the materials used, but since a foundry nearly always has on hand several lots of the same material, bought at different prices, the problem of what price to use causes serious inaccuracies in costing.

It must be remembered that when the materials or supplies are purchased, the amounts of these purchases are charged to the Inventory Account in the general ledger, and when they are withdrawn from stock the value of the withdrawals are credited to the accounts. Obviously it is necessary to price the materials and supplies used correctly, if the proper balance is to be kept in the value of the running inventory. That is why a standard price, used through the year for any material, is inaccurate; yet this method is quite commonly used.

The average price method is illustrated in Form 22. There is a more correct method, which is to cost out the materials and supplies at the price purchased plus any freight and carrying charges, using this price until the quantity on each lot is exhausted.

Let us now refer to the stores inventory record, Form 12. This form provides for the entry and usage of each

individual lot of material or supplies purchased. The first lot recorded is 1,000 units at $0.50 which was entirely exhausted before the new lot was drawn upon, although the new lot was received March 1 and the material was being issued from the first lot up to and including March 6. On March 6, 100 units were requisitioned, but there were only 50 left in the first lot; consequently the requisitions were priced, 50 at $0.50 each to close out the first lot, and 50 at $0.55 each to begin withdrawals from the second lot. It will be clear that in practice it is not necessary actually to use first that lot which was first received, but in pricing the issued material and supplies, the price of the first lot received should be used until the equivalent in quantity of that lot has been used. The physical inventory must be priced in the same way.



STORES INVENTORY RECORD

(ILLUSTRATING THE EFFECT OF AVERAGING PRICES)

RECEIVED			ISSUED			BALANCE			
QUAN	UNIT PRICE	AMOUNT	QUAN	UNIT PRICE	AMOUNT	QUAN.	UNIT PRICE	AMOUNT	
1000	.50	500 00	500	.50	250 00	500	.50	250 00	
1000	.40	400 00				1500	.433	650 00	AVERAGE PRICE
			700	.433	303 10	800	.433	346 40	
			500	.433	216 50	300	.433	129 90	
1000	.30	300 00				1300	.3306	429 90	AVERAGE PRICE
			500	.3307	165 35	800	.3306	264 48	
			800	.3307	264 56	0			
3000		1200 00	3000		1199 51				TOTALS

$ 1200.00 DEBIT TO INVENTORY LEDGER ACCOUNT
1199 51 CREDIT TO " " "
.49 DIFFERENCE

FIG. 22.

Whether the material be bolts, pig iron, sand, coke or miscellaneous supplies, the same method must be used in order to keep the book inventory in the general ledger in agreement with the physical inventory. Persistent checking of the physical inventory will keep the inaccuracies due to shrinkage and error of count to a minimum and avoid any marked discrepancies which would otherwise develop.

42. Pricing Pig and Scrap.—There is a necessary exception in the general method of accounting for materials, to be noted in the case of pig and scrap iron.

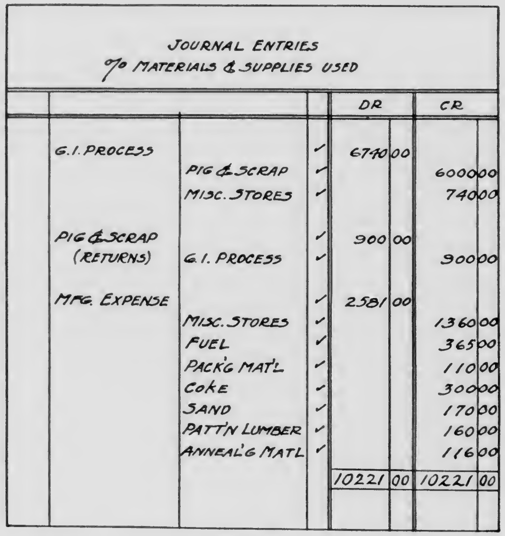
The daily foundry report, Form 19, shows the amount of material used and the foundry production as a whole. The actual consumption of pig and scrap iron however, is not the weight drawn from the physical stock, as recorded on the stores inventory record, but is the total weight found in the good castings produced, plus the loss in melting. The balance, including defective castings, gates, sprues and over-iron, is remelted and moved in a circle, so to speak.

However, the Pig and Scrap Account must be credited with the full value, at cost, of the amount drawn from stock and the goods in Process Account debited. Then from the report of the total scrap produced, the Goods in Process Account is credited with the scrap at scrap value, and the Pig and Scrap Account debited in order to get the scrap back into the inventory at the correct value. The stores inventory record has this scrap weight added to its account.

This method leaves in the Goods in Process Account the difference between the original value of the iron charged and its equivalent in scrap plus the value of the net loss of the heats. This difference is absorbed in the cost figures through the development of the cost per pound of good castings. This cost calculation will be illustrated in detail in the chapter on the expense analysis of the Melting Department.

43. Adjusting the Inventory Account.—So far we have assumed there has been no change in the market price of pig and scrap. The purchase price of pig is taken at $34

per net ton and this price is used in building up the ledger accounts and accounting for the materials used. If pig iron should drop to $28 per ton, the loss may be taken by depreciating the value of the inventory to the $28 price and the difference journalized to an Inventory Adjustment



JOURNAL ENTRIES
TO MATERIALS & SUPPLIES USED

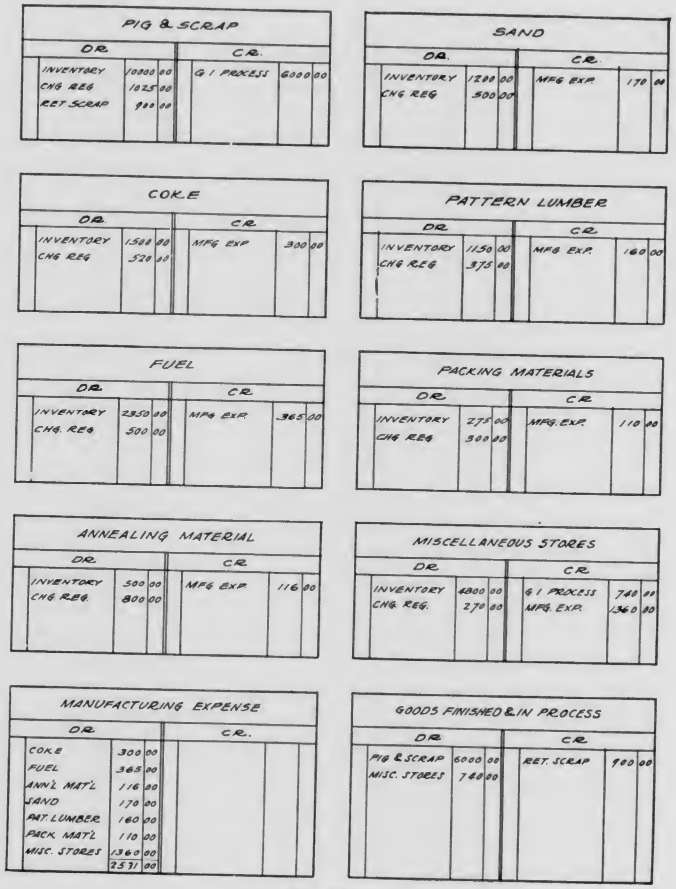
				DR		CR	
	G. I. PROCESS		✓	6740	00		
		PIG & SCRAP	✓			6000	00
		MISC. STORES	✓			740	00
	PIG & SCRAP (RETURNS)		✓	900	00		
		G. I. PROCESS	✓			900	00
	MFG. EXPENSE		✓	2581	00		
		MISC. STORES	✓			1360	00
		FUEL	✓			365	00
		PACK'G MAT'L	✓			110	00
		COKE	✓			300	00
		SAND	✓			170	00
		PATT'N LUMBER	✓			160	00
		ANNEAL'G MAT'L	✓			116	00
				10221	00	10221	00

FIG. 23.

Account; but when this is done, the $28 price must be used in figuring the cost of materials used, in order to keep the controlling account at the correct amount; otherwise this account will not check with the physical inventory.

The pricing of an inventory must be at cost or market, whichever is lower, but we cannot appreciate these values.

The status of the ledger accounts after making the proper entries for the use of materials and supplies are shown on Forms 23 and 24.



PIG & SCRAP

DR.			CR.		
INVENTORY	10000	00	G I PROCESS	6000	00
CHG REG	1025	00			
RET SCRAP	900	00			

SAND

DR.			CR.		
INVENTORY	1200	00	MFG EXP.	170	00
CHG REG	500	00			

COKE

DR.			CR.		
INVENTORY	1500	00	MFG EXP	300	00
CHG REG	520	00			

PATTERN LUMBER

DR			CR		
INVENTORY	1150	00	MFG EXP.	160	00
CHG REG	375	00			

FUEL

DR			CR		
INVENTORY	2350	00	MFG EXP.	365	00
CHG. REG	500	00			

PACKING MATERIALS

DR			CR		
INVENTORY	275	00	MFG. EXP.	110	00
CHG REG	300	00			

ANNEALING MATERIAL

DR			CR		
INVENTORY	500	00	MFG EXP.	116	00
CHG REG.	800	00			

MISCELLANEOUS STORES

DR			CR		
INVENTORY	4800	00	G I PROCESS	740	00
CHG. REG.	270	00	MFG. EXP.	1360	00

MANUFACTURING EXPENSE

DR			CR.		
COKE	300	00			
FUEL	365	00			
ANN'L MAT'L	116	00			
SAND	170	00			
PAT. LUMBER	160	00			
PACK MAT'L	110	00			
MISC. STORES	1360	00			
	2531	00			

GOODS FINISHED & IN PROCESS

DR			CR		
PIG & SCRAP	6000	00	RET. SCRAP	900	00
MISC. STORES	740	00			

Fig. 24.

CHAPTER VI

ANALYZING LABOR COSTS

Knowledge of the weekly fluctuations of the payroll gives the foundryman no adequate control of the large amount of money spent for labor. To exercise real control—that is, to get the most for his money—he must know how this labor is used and its amount in proportion to the production, its amount by departments and the relation of non-productive to productive labor.

The labor costs must be analyzed and controlled through the use of a carefully selected method which will give the information needed and yet avoid heavy clerical expense. The method must be simple, yet elastic and accurate in its workings. It is entirely possible to meet these specifications.

44. Two Kinds of Labor.—The labor in every foundry may be classified as productive and non-productive. Productive labor is charged directly to the product. Non-productive labor serves production indirectly by aiding the productive employes and cannot be charged directly to the product. It therefore becomes a part of the expense of the department and later finds its way to the cost of the castings produced.

On the Charge Register, Form 3, the weekly payroll was entered in the payroll column. At the close of the month, this amount was credited to Accounts Payable and debited to the Payroll Account as is shown on the chart of accounts, Form 2. Since the productive labor goes directly to the product, the amount of this labor becomes a part of the cost of the goods in process of manufacture, and it is therefore credited to the Payroll Account and debited to the Goods in Process Account.

Since the non-productive labor is a part of the expense, it becomes a credit to the Payroll Account and a debit to the Manufacturing Expense Account. The payroll amounts, so divided, flow monthly to the controlling ledger accounts and need no further analysis in the general books.

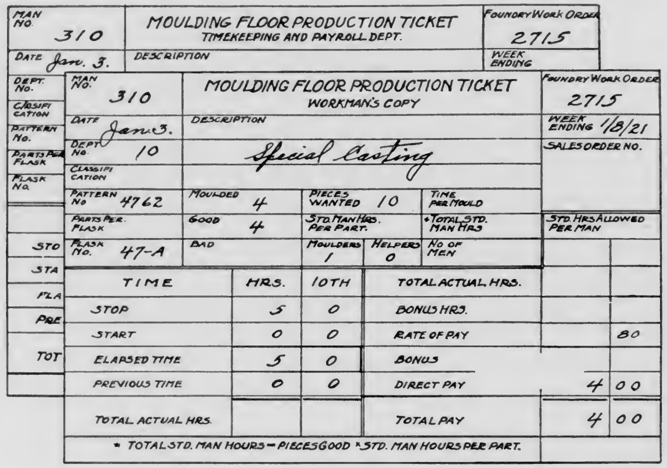
The chart of accounts shows clearly the entries, but the amounts must be distributed to the proper classification in the department, for the money paid for the productive labor will have been on account of the melters, core makers, moulders, cleaners, machinists, etc., while the non-productive wages have been for the fireman, engineer, general helpers, pattern men, flask men, clerks, etc. A portion of the labor may have been working on new equipment or new buildings in which case the amount so paid must be charged to the Asset Accounts.

45. Accounting for Labor.—To assure that the labor costs will be correct, the labor must be accounted for as used, so that the ledger accounts will reflect the manufacturing conditions. The correct means of recording the labor is through the use of a time card or its equivalent. The time card (sometimes called a "service card" or "work ticket") is in more general use than any other form. Its design will depend very much upon the condition under which it is to be used. A single form, in some instances, may serve an entire plant, while in another foundry different forms may be required for each department.

In any foundry, two kinds of time cards are needed, one for productive labor and one for non-productive.

Form 25, the productive card, is made out in triplicate, one copy for the workman, one for time keeping and payroll and the third copy for recording production and the collection of costs.

The time is best recorded in hours and tenths by a central control time stamp. The mechanical recording clock is preferred because of its accuracy, but the small plant can save by using a clock with a tenth-hour dial, Form 27. This dial can be made up in blueprint form and attached to the clock at a very small cost. To read time from the dial illustrated, the hour hand only is necessary, the minute hand being removed. In the illustration both hands are shown, the idea being to paint the minute hand white, leaving a black tip, thus serving as an aid in reading the regular time from the standard dial shown on the inner



MAN NO. 310

MOULDING FLOOR PRODUCTION TICKET
TIMEKEEPING AND PAYROLL DEPT.

FOUNDRY WORK ORDER 2715

DATE Jan. 3.

DESCRIPTION

WEEK ENDING

DEPT. NO.

CLASSIFICATION

PATTERN NO.

PARTS PER FLASK

FLASK NO.

STO

STA

FLA

PRE

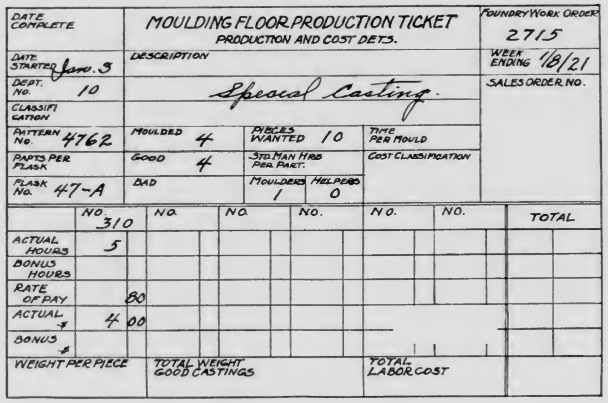
TOT

MAN NO. 310	MOULDING FLOOR PRODUCTION TICKET WORKMAN'S COPY			FOUNDRY WORK ORDER 2715
DATE Jan. 3.	DESCRIPTION			WEEK ENDING 1/8/21
DEPT NO. 10	Special Casting			SALES ORDER NO.
CLASSIFICATION				
PATTERN NO 4762	MOULDED 4	PIECES WANTED 10	TIME PER MOULD	
PARTS PER FLASK	GOOD 4	STD. MAN HRS. PER PART.	*TOTAL STD. MAN HRS	STD. HRS ALLOWED PER MAN
FLASK NO. 47-A	BAD	MOULDERS 1 / HELPERS 0	NO OF MEN	

TIME	HRS.	10TH			
			TOTAL ACTUAL HRS.		
STOP	5	0	BONUS HRS.		
START	0	0	RATE OF PAY		80
ELAPSED TIME	5	0	BONUS		
PREVIOUS TIME	0	0	DIRECT PAY	4	00
TOTAL ACTUAL HRS.			TOTAL PAY	4	00

* TOTAL STD. MAN HOURS = PIECES GOOD × STD. MAN HOURS PER PART.

FORM 25.



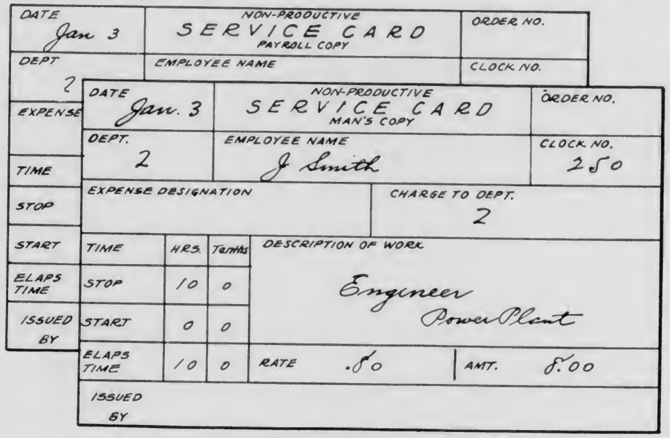
DATE COMPLETE	MOULDING FLOOR PRODUCTION TICKET PRODUCTION AND COST DETS.			FOUNDRY WORK ORDER 2715
DATE STARTED Jan. 3	DESCRIPTION			WEEK ENDING 1/8/21
DEPT. NO. 10	Special Casting.			SALES ORDER NO.
CLASSIFICATION				
PATTERN NO. 4762	MOULDED 4	PIECES WANTED 10	TIME PER MOULD	
PARTS PER FLASK	GOOD 4	STD. MAN HRS PER PART.	COST CLASSIFICATION	
FLASK NO. 47-A	BAD	MOULDERS 1 / HELPERS 0		

	NO. 310	NO.	NO.	NO.	NO.	NO.	TOTAL
ACTUAL HOURS	5						
BONUS HOURS							
RATE OF PAY	80						
ACTUAL $	4 00						
BONUS $							

WEIGHT PER PIECE	TOTAL WEIGHT GOOD CASTINGS	TOTAL LABOR COST	

FORM 25A.

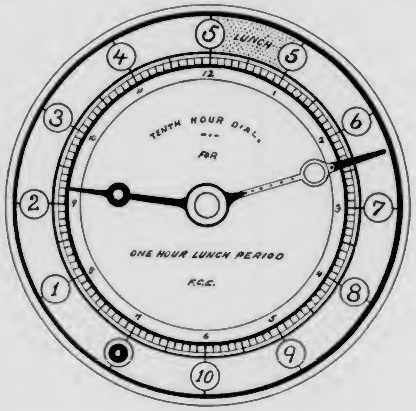
circle; but to read the elapsed time in hours and tenths the hour hand only should be used. The dial shows the starting time for the day at seven o'clock which is indicated as zero hour, the hour hand pointing to 2.2 hours or twelve minutes past nine. The one-hour lunch period shows at noon, five hours elapsed time, and at one o'clock the reading



DATE Jan 3
NON-PRODUCTIVE
SERVICE CARD
PAYROLL COPY
ORDER NO.
DEPT 2
EMPLOYEE NAME
CLOCK NO.
EXPENSE
TIME
STOP
START
ELAPS TIME
ISSUED BY

DATE Jan. 3	NON-PRODUCTIVE SERVICE CARD MAN'S COPY			ORDER NO.
DEPT. 2	EMPLOYEE NAME J Smith			CLOCK NO. 250
EXPENSE DESIGNATION			CHARGE TO DEPT. 2	
TIME	HRS.	Tenths	DESCRIPTION OF WORK	
STOP	10	0	Engineer Power Plant	
START	0	0		
ELAPS TIME	10	0	RATE .80	AMT. 8.00
ISSUED BY				

Form 26.



Form 27.

is still five hours elapsed time. This arrangement automatically eliminates the noon hour from the day's readings and the straight time can be recorded in hours and tenths without calculation.

Only two copies of the non-productive tickets, Form 26, are made out since no ticket is required by the production department.

46. Labor Transfers.—If a non-productive workman is on but one job during the day, but one set of these cards is required for that day and the finished card will appear as the one shown for the engineer. But if he is transferred during the day, the cards should be changed when the transfer takes place, so that the kinds of work performed and the time on each job may be correctly recorded. This same holds true for the productive service card. If a moulder works on one job the entire day, but one card is required. If he works on several jobs, the time for each job must be recorded on separate cards, if the cost collection for costing an order is to be correct.

It does not necessarily follow that exactly this method of accounting for time must be used in every foundry. In some foundries a change of time cards for every change of jobs on the moulding floor, would cause a great waste of time and make necessary a large amount of clerical detail. The kind of time card to be used and the method of accounting for the time must be developed to fit the particular foundry in which the application is to be made. This description is merely to illustrate a method and show the importance of accounting for time correctly in order to secure accurate costs.

A foundry that handles a large variety of work may satisfactorily get the cost per pound of good castings by classification. In this case, but one time card per producer per day is required; or the time may be accounted for through a labor report.

Another way is to account for the labor through a "take-up record" on which the castings made are recorded and the piece price figured into the moulder's record of work done.

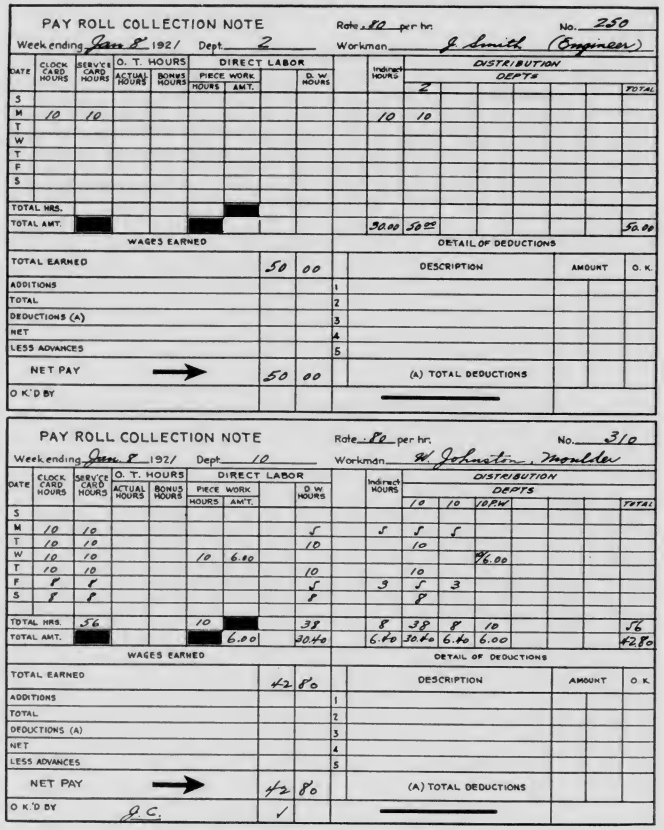
The take-up record is used to excellent advantage in stove, boiler and heater foundries. A modified form of this record is especially good with standard production such as radiator sections where all the moulding is on a piece work basis.

These latter methods, however, can not be used in the machine shop for the nature of the work is different and a different form of time ticket or service card is required. The non-productive card, Form 26, can be used in any department of the entire plant.

47. Checking the Time Cards.—With a complete set of time cards reported for a workman showing his entire time for the day, whether productive or non-productive, a further check on his time is essential and this check is through the use of tickets from the IN and OUT clocks. This checking serves also as a means of catching errors in the reporting of time. If the total time on the time ticket does not check with the clock cards, an investigation is at once called for and the correction made the next morning. These discrepancies should not be allowed to hang over until the last day in the pay period. They should be checked and corrected daily. It saves endless discussion and considerable time when making up the payroll at the end of the week or period.

When the time cards are finally checked they are ready to be entered into the payroll record through a form such as the payroll collection note, Form 28, which, as shown, covers a pay period of one week. If the pay period is two weeks or twice a month, an extension in the form for the required number of days is all that is necessary. On the upper illustration, man No. 250 is recorded from the non-productive ticket shown in Figure 23. This recording of time continues during the week and his total pay is figured on this sheet which gives the record in detail for each workman for the whole pay period.

Similarly with the productive work, the time is recorded for workmen No. 310 on the lower illustration, Form No. 28A. The first record of time shows five hours' productive day work, and from a non-productive ticket, five hours. The recording has been continued during the week showing the man's time for piece work, day work and non-productive time, all of which has been carried to the distribution column at the right of the form. The hours only have been distributed. This allows the extensions to be made at the end of the pay period with one calculation. In the distribution columns are totals giving a sum equal to the



PAY ROLL COLLECTION NOTE
Rate .80 per hr.
No. 250
Week ending Jan 8 1921
Dept. 2
Workman J. Smith (Engineer)

DATE	CLOCK CARD HOURS	SERV'CE CARD HOURS	O. T. HOURS		DIRECT LABOR					Indirect HOURS	DISTRIBUTION						
			ACTUAL HOURS	BONUS HOURS	PIECE WORK			D. W. HOURS			DEPTS						
					HOURS	AMT.					2						TOTAL
S																	
M	10	10								10	10						
T																	
W																	
T																	
F																	
S																	
TOTAL HRS.						■											
TOTAL AMT.		■			■					30.00	50.00						50.00

WAGES EARNED			DETAIL OF DEDUCTIONS			
TOTAL EARNED	50	00		DESCRIPTION	AMOUNT	O. K.
ADDITIONS			1			
TOTAL			2			
DEDUCTIONS (A)			3			
NET			4			
LESS ADVANCES			5			
NET PAY →	50	00		(A) TOTAL DEDUCTIONS		
O K'D BY						

PAY ROLL COLLECTION NOTE
Rate .80 per hr.
No. 310
Week ending Jan. 8 1921
Dept. 10
Workman W. Johnston, Moulder

DATE	CLOCK CARD HOURS	SERV'CE CARD HOURS	O. T. HOURS		DIRECT LABOR					Indirect HOURS	DISTRIBUTION						
			ACTUAL HOURS	BONUS HOURS	PIECE WORK			D W HOURS			DEPTS						
					HOURS	AM'T.					10	10	10P.W				TOTAL
S																	
M	10	10						5		5	5	5					
T	10	10						10			10						
W	10	10			10	6.00							10/6.00				
T	10	10						10			10						
F	8	8						5		3	5	3					
S	8	8						8			8						
TOTAL HRS.		56			10	■		38		8	38	8	10				56
TOTAL AMT.		■			■	6.00		30.40		6.40	30.40	6.40	6.00				42.80

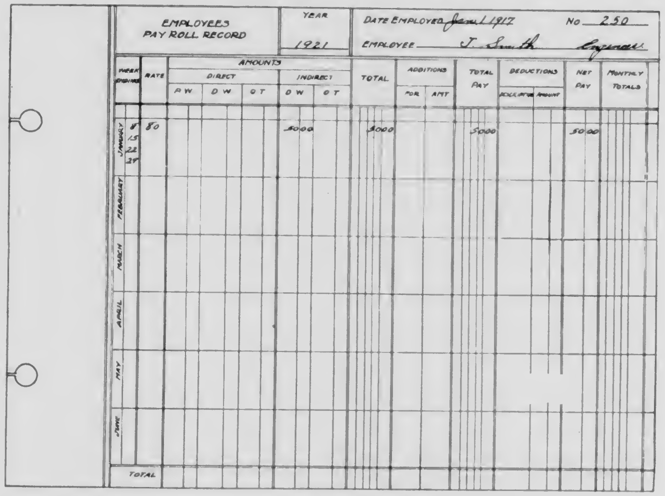
WAGES EARNED			DETAIL OF DEDUCTIONS			
TOTAL EARNED	42	80		DESCRIPTION	AMOUNT	O K
ADDITIONS			1			
TOTAL			2			
DEDUCTIONS (A)			3			
NET			4			
LESS ADVANCES			5			
NET PAY →	42	80		(A) TOTAL DEDUCTIONS		
O K'D BY J. C.	✓					

FORMS 28 (ABOVE) AND 28A (BELOW).

total of $42.80, which checks with the total in the columns to the left. The analysis further shows:

Day work, hours........	38	Amount	$30.40	Productive
Piece work, hours.......	10	Amount	6.00	Productive
Non-productive.........	8	Amount	6.40	Non-productive
Total................	56		$42.80	

This form gives a complete analysis of the workman's time for the entire pay period. It may be used as the permanent payroll record with the sheets filed by man number, in the order of calender weeks, for ready references. Whether or not it is used in that way, it is essential as a collection record for the time cards.



EMPLOYEES PAY ROLL RECORD

YEAR 1921

DATE EMPLOYED Jan. 1 1917

NO 250

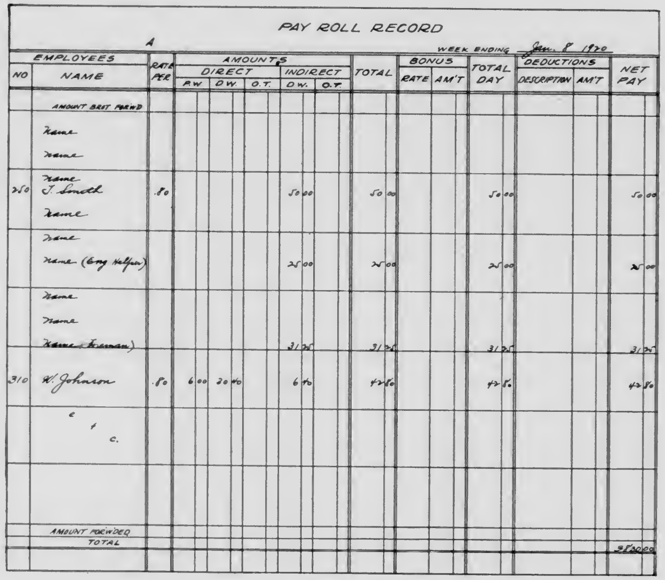
EMPLOYEE J. Smith Engineer

WEEK ENDING		RATE	AMOUNTS DIRECT P.W.	D.W.	O.T.	INDIRECT D.W.	O.T.	TOTAL	ADDITIONS FOR	AMT	TOTAL PAY	DEDUCTIONS ACC'T	AMOUNT	NET PAY	MONTHLY TOTALS
JANUARY	8	80				50 00		50 00			50 00			50 00	
	15														
	22														
	29														
FEBRUARY															
MARCH															
APRIL															
MAY															
JUNE															
TOTAL															

FORM 29.

48. The Payroll Record.—Form 29 is a permanent payroll record which serves to better advantage than Form 28, in that the entire record of the employe for the year is on the one sheet, the last six months of the year being provided for on the reverse side of the form. All of the other features covered on Form 28 are incorporated in this form and make the writing of a complete payroll list unnecessary.

Form 30 is another form of permanent payroll record which is in more general use. It is similar to Form 29, but is not an individual record. The names of all employes are listed on the master sheet and the earnings posted from the payroll collection note. A slip sheet at the point "A" may be used for each pay period for a month or more before rewriting is necessary. This form of payroll record is in some ways the most desirable because the complete payroll is always on record and available for the auditor at any time. Form 28 may serve for income tax purposes or the employes' earnings may be a matter of record with the employment or payroll department. All of these points are brought up to show how the cost and other uses



PAY ROLL RECORD

A

WEEK ENDING Jan. 8 1920

EMPLOYEES NO	NAME	RATE PER	AMOUNTS DIRECT P.W.	D.W.	O.T.	INDIRECT D.W.	O.T.	TOTAL	BONUS RATE	AM'T	TOTAL DAY	DEDUCTIONS DESCRIPTION	AM'T	NET PAY
	AMOUNT BRT FORWD													
	Name													
	name													
	name													
250	J. Smith	.80				50 00		50 00			50 00			50 00
	name													
	name													
	name (Eng Helper)					25 00		25 00			25 00			25 00
	name													
	name													
	Name (Foreman)					31 25		31 25			31 25			31 25
310	W. Johnson	.80	6 00	20 40		6 40		42 80			42 80			42 80
	e t c.													
	AMOUNT FORW'DED													
	TOTAL													3820 00

FORM 30.

of the payroll records may be combined to save clerical effort.

49. Classifications of Labor.—It is now necessary to collect the labor charges from the payroll collection note in order to make the necessary charges to the departments. The labor classifications for each department of a typical foundry is here shown in detail and in accordance with the labor items set up in the expense analysis, which will be discussed in later chapters.

CLASSIFICATION OF NON-PRODUCTIVE AND PRODUCTIVE LABOR

DEPT. NO. — DEPARTMENT AND CLASSIFICATION

1 *Steam (Boiler):*
- Firemen
- Maintenance labor
- Miscellaneous labor:
  - Coal handlers, sweepers, etc.

2 *Power and Light:*
- Engineer and Assistants
- Maintenance labor
- Miscellaneous labor:
  - Oilers, wipers, etc.

3 *Tool and Maintenance:*
- Fireman
- Miscellaneous labor:
  - General helpers, oilers, sweepers, etc.
- Mechanics:
  - Millwrights
  - Plumbers
  - Electricians
  - Carpenters
  - Blacksmiths, etc.

4 *Pattern Shops:*
- Foreman
- Miscellaneous labor:
  - Sweepers, etc.
- Pattern Makers

5 *General Office:*
- All Executives
- All Main Office Clerks
- All Engineering

6 *General Factory:*
- General Superintendent and Assistant
- All General Factory Clerks, not including those clerks who may be charged direct to a department

- General Planning and Productive Clerks
- Store Room and Receiving Clerks
- Watchmen and janitors
- General Yard labor
- Truckmen
- All Miscellaneous labor, such as may be used about the plant for general purposes.

7 *General Foundry:*
- Foundry Superintendent
- General Foreman
- Pattern Storage Help, for handling of active patterns
- Flask and Equipment Help
- Chemists—if used for foundry purposes only. If for General Factory services, the chemists should be charged into Dept. #6, General Factory
- Crane Operators—depending upon the service rendered. If there are separate cranes for the various departments in the foundry, the crane operator should be charged direct
- Ladle daubers
- Miscellaneous labor:
  - All odd labor used generally about the foundry

8 *Melting:*
- Any Miscellaneous labor
- Unloading melting materials
- Breaking scrap and handling iron
- Handling Slag and Drop
- Direct melting labor

9 *Core Room:*
- Foreman
- All miscellaneous help:
  - Unloading core sand
  - Wheeling and Mixing
  - Loading and tending ovens
  - Handling cores
  - Inspection
- Direct—Core Makers

10 *Moulding:*
- Foreman and assistants
- Miscellaneous labor:
  - Preparing sand
  - Crane operators (if direct)
  - Drying moulds
  - Closing and Clamping moulds
  - Pouring gang
  - Shaking out
  - Cleaning and sweeping, etc.
- Moulders and direct helpers

11 *Cleaning:*
Foreman
Miscellaneous labor:
Inspection
Crane Operators (if direct)
Handling castings
Taking out scrap and refuse
Cleaning and sweeping
Handling miscellaneous materials, etc.
Direct cleaners and chippers

12 *Annealing:*
Foreman
Miscellaneous labor:
Oven tenders
Handling castings
Sweepers, etc.
Direct Annealing labor

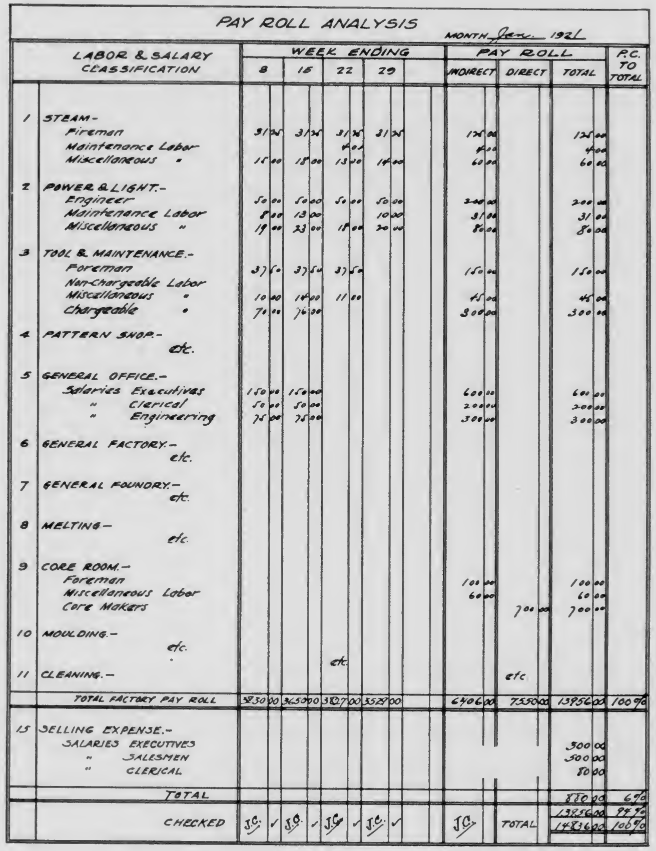
13 *Machine Shop:*
Foreman and Assistants
Miscellaneous labor:
Crane operators
General helpers:
Oilers, sweepers, etc.
Tool crib attendants
Direct Machinists

14 *Packing and Shipping:*
Foreman
Shipping clerks
Packing and Shipping labor
Cleaners and Sweepers, etc.

15 *Selling Expense:*
Salaries—Executives
Salaries—Clerical
Salaries—Salesmen.

Such an outline can, of course, be only suggestive. The exact list must be made up to meet the conditions in the individual foundry.

50. The Payroll Analysis.—To collect all labor in a form which will permit of ready proof and convenient posting to the expense analysis, the payroll analysis sheet, Form 31, is used. This data is gathered from the payroll collection notes and the statement made up from the office private payroll record. It is then entered weekly on the payroll analysis. The departments' labor and salary items are arranged on this form exactly as they will be found in the expense analysis. When the entries are completed the total $3,830 for the first week of January 8, for instance, must check with the payroll for the week. At the end of the month the items are totaled across the page and proved with the sum of the weekly totals as a check against errors. The analysis also gives the amounts



PAY ROLL ANALYSIS

MONTH Jan. 1921

	LABOR & SALARY CLASSIFICATION	WEEK ENDING					PAY ROLL			P.C. TO TOTAL
		8	15	22	29		INDIRECT	DIRECT	TOTAL	
1	STEAM.-									
	Fireman	31 25	31 25	31 25	31 25		125 00		125 00	
	Maintenance Labor			4 00			4 00		4 00	
	Miscellaneous "	15 00	18 00	13 00	14 00		60 00		60 00	
2	POWER & LIGHT.-									
	Engineer	50 00	50 00	50 00	50 00		200 00		200 00	
	Maintenance Labor	8 00	13 00		10 00		31 00		31 00	
	Miscellaneous "	19 00	23 00	18 00	20 00		80 00		80 00	
3	TOOL & MAINTENANCE.-									
	Foreman	37 50	37 50	37 50			150 00		150 00	
	Non-Chargeable Labor									
	Miscellaneous "	10 00	14 00	11 00			45 00		45 00	
	Chargeable "	70 00	76 00				300 00		300 00	
4	PATTERN SHOP.-									
	etc.									
5	GENERAL OFFICE.-									
	Salaries Executives	150 00	150 00				600 00		600 00	
	" Clerical	50 00	50 00				200 00		200 00	
	" Engineering	75 00	75 00				300 00		300 00	
6	GENERAL FACTORY.-									
	etc.									
7	GENERAL FOUNDRY.-									
	etc.									
8	MELTING-									
	etc.									
9	CORE ROOM.-									
	Foreman						100 00		100 00	
	Miscellaneous Labor						60 00		60 00	
	Core Makers							700 00	700 00	
10	MOULDING.-									
	etc.			etc.						
11	CLEANING.-							etc		
	TOTAL FACTORY PAY ROLL	3830 00	3650 00	3827 00	3529 00		6406 00	7550 00	13956 00	100%
15	SELLING EXPENSE.-									
	SALARIES EXECUTIVES								300 00	
	" SALESMEN								500 00	
	" CLERICAL								80 00	
	TOTAL								880 00	6%
									13956 00	94%
	CHECKED	J.C. ✓	J.C. ✓	J.C. ✓	J.C. ✓		J.C.	TOTAL	14836 00	100%

Form 31.

of indirect, direct and total payroll for the entire plant, as well as the salary list of the Sales Department.

PAY ROLL ANALYSIS Month ________ 19___

Labor + Salary Classification	Non-Productive Departments												Productive Departments								Pack'g	Factory Pay Roll			Percent to Total	Selling
	1	2	3	4	5	6	7	Assets				G.I.P. Orders	8	9	10			11	12	13	14	In-Direct	Direct	Total		15
								New Bldg's	New Equip't	New Tools	New Patt'ns				Mould'g	Flask Repairs	Pattern Repair									
Firemen	125.00																					125.00			.90	
Miscellaneous Labor	60.00	80.00	45.00	40.00		14.00	150.00						80.00	60.00	115.00			50.00	52.00	125.00	38.00	905.00			6.50	
Engineer		200.00																				200.00			1.43	
Foremen			150.00	140.00			100.00							100.00	175.00			125.00	125.00	150.00		1065.00			7.64	
Non Chargeable Maint																										
chargeable	4.00	31.00		25.00	5.00	20.00	10.00		60.00	30.00			30.00	10.00	35.00			20.00	17.00	28.00	10.00	335.00			2.40	
Pattern Makers, Chargable									75.00		150.00	100.00				33.00	42.00					400.00			2.87	
Salaries Executive					600.00																	600.00			4.30	
" Clerical					200.00	100.00																300.00			2.15	
" Engineering					300.00																	300.00			2.15	
" Supervision						300.00	250.00															550.00			3.94	
" Purchasing						350.00																350.00			2.51	
" Planing						200.00																200.00			1.43	
Receiving + Stores						75.00																75.00			.54	
Watchmen + Janitors						50.00																50.00			.36	
Yard + Truckmen						147.00																147.00			1.06	
Pattern Storage							120.00															120.00			.86	
Flask + Equipment							200.00															200.00			1.43	
Chemists							200.00															200.00			1.43	
Total	189.00	311.00	195.00	205.00	1105.00	1256.00	1030.00		135.00	30.00	150.00	100.00	110.00	170.00	325.00	33.00	42.00	195.00	194.00	303.00	48.00			6126.00	43.90	
Direct Melting													350.00										350.00		2.51	
Core Room														700.00									700.00		5.02	
Moulding															3200.00								3200.00		22.90	
Cleaning																		700.00					700.00		5.02	
Annealing																			600.00				600.00		4.30	
Machine																				2000.00			2000.00		14.35	
Total													350.00	700.00	3200.00			700.00	600.00	2000.00				7550.00	54.10	
Shipping Clerk																					120.00	120.00			.85	
Packing + Shipping Labor																					160.00	160.00			1.15	
Total																								280.00	2.00	
Total Factory Pay Roll																						6406.00	7550.00	13956.00	100%	
Departmental Totals													460.00	870.00	3525.00	33.00	42.00	895.00	794.00	2303.00	328.00			13956.00	94%	
Salaries Sales Executive																										300.00
" Salesmen																										500.00
" Clerical																										80.00
Selling Total																								880.00	6%	880.00
Grand Total																								14836.00	100%	

The Pay Roll Account is Debited with $13956.00 From the Charge Register

Journal Entries	DR	CR
Pay Roll		13956.00
Goods Fin + in Process	7550.00	
Manufact'g Expense	6406.00	
	13956.00	13956.00

The Selling Expense Account is Debited With $880.00 From The Charge Register

FORM 32.

The chart of accounts, Form 2, and the charge register, Form 3, show how these entries have been carried into

the General Ledger. See also the accounts affected on Form 33.

Observe that this analysis of the payroll, in its simplest form, gives the ratios of any labor or salary item to the total as well as the proportion of manufacturing and selling payroll.

The form of analysis shown in Form 32, which provides a more extensive analysis is advisable for the larger plants, although it may be used with equal profit in the small plant. All the labor and salary classifications, and the amounts opposite these items are entered under each department, so that the columns to the right, headed "indirect" and "direct," give the total of each labor or salary classification for the entire plant and in addition, the per cent of each item to the total payroll.

For instance:

	AMOUNT		PER CENT	
All expense, labor and salary items exclusive of the Packing and Shipping Department	$ 6,126.00	or	43.9	
Packing and Shipping	280.00		2.0	
Total Non-productive	6,406.00		45.9	
Direct labor	7,550.00		54.1	
Total Executive and Factory Payroll	13,956.00		100.0	94
Selling Expense	880.00			6
Total	$14,836.00			100

Such an analysis may be used to excellent advantage for watching the fluctuation of the percentages. When fluctuations occur a reference to the expense analysis will reveal the cause and indicate the steps to be taken.

Observe that the departmental totals on Form 32, are not the same as those in the expense analysis. This is because all maintenance and pattern labor have been distributed across the sheet to the departments, in order to show in the total columns the full amount of this class of labor. In the expense analysis the sum of these amounts has been posted directly to the departments by which the work was done and later distributed with a share of the departmental overhead. (See Depts. 3 and 4).

The journal entries required are shown at the bottom of the form.

PAY ROLL					
DR			CR		
CHG. REG.	13956	00	G. I. PROCESS	7550	00
			MFG. EXP.	6406	00
	13956	00		13956	00

GOODS FINISHED & IN PROCESS					
DR			CR		
PAY ROLL	7550	00			

MANUFACTURING EXPENSE.					
DR			CR		
PAY ROLL	6406	00			

FORM 33.

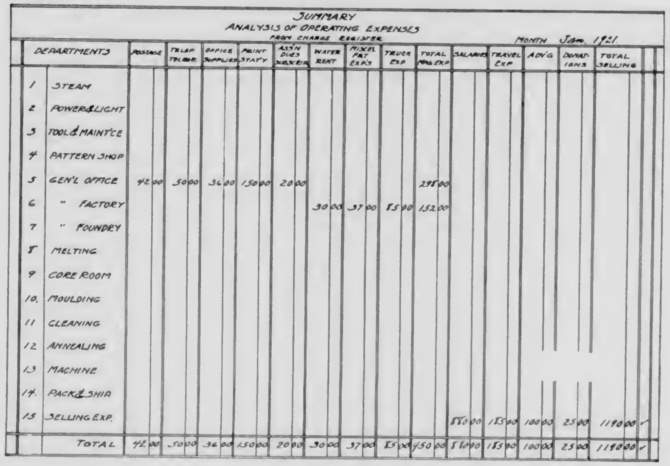
51. Journalizing the Labor Charges.—The time cards have now given all of the information necessary for payroll purposes. The necessary routine is to have all time cards reported each morning for immediate checking. Following the labor accounting for the payroll, the productive time cards may be filed by operation number, part number or order number, so that the labor costs may be readily totaled against the castings being made. The non-productive time cards are filed by departments and labor classification for use at the end of the pay period or month.

We have now considered all of the items of expense which, when taken together, constitute the general overhead. The status of accounts for the disposition of the payroll, Form 33, show how all these entries have been made. There will be other charges to the general accounts as the expense analysis is developed. These items will be explained in the succeeding chapters.

CHAPTER VII

THE DEPARTMENTAL EXPENSE ANALYSIS

We have now seen how charges to the Manufacturing Expense Account in the ledger have been built up from five sources; the charge register, the petty cash fund, the fixed charge sheet, the non-productive labor service cards and the supply requisitions. Since this total amount constitutes the manufacturing overhead expense of the business, all of the items in it must appear on the proper departmental expense analysis. To facilitate this distribution, each item in the Manufacturing Expense column of the charge register bears a number to indicate to which department it is chargeable. These items are collected and summarized for convenience in posting to the expense analysis on Form 34, which is self-explanatory.



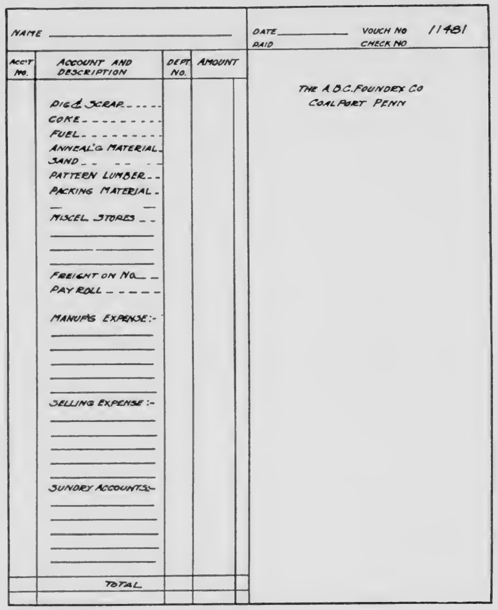
SUMMARY
ANALYSIS OF OPERATING EXPENSES
FROM CHARGE REGISTER
MONTH Jan. 1921.

	DEPARTMENTS	POSTAGE	TELEP TELEGR	OFFICE SUPPLIES	PRINT STAT'Y	ASS'N DUES SUBSCRIP	WATER RENT	MISCEL FRT EXP'S	TRUCK EXP	TOTAL MFG EXP	SALARIES	TRAVEL EXP	ADV'G	DONATIONS	TOTAL SELLING	
1	STEAM															
2	POWER & LIGHT															
3	TOOL & MAINT'CE															
4	PATTERN SHOP															
5	GEN'L OFFICE	42 00	50 00	36 00	150 00	20 00				295 00						
6	" FACTORY						30 00	37 00	85 00	152 00						
7	" FOUNDRY															
8	MELTING															
9	CORE ROOM															
10.	MOULDING															
11	CLEANING															
12	ANNEALING															
13	MACHINE															
14.	PACK & SHIP															
15	SELLING EXP.										880 00	185 00	100 00	25 00	1190 00	✓
	TOTAL	42 00	50 00	36 00	150 00	20 00	30 00	37 00	85 00	450 00	880 00	185 00	100 00	25 00	1190 00	✓

Form 34.

In the same way the fixed charge sheet shows just how much of each item of insurance, taxes and depreciation must be borne by each department.

Also we saw, in Chapter V, how the supplies or expense materials are summarized by departments on Form 21. In Chapter VI, the non-productive labor is summarized by departments on Forms 31 or 32, and the petty cash items may be listed by departments on Form 35.



NAME ____________
DATE ________ VOUCH NO 11481
PAID CHECK NO

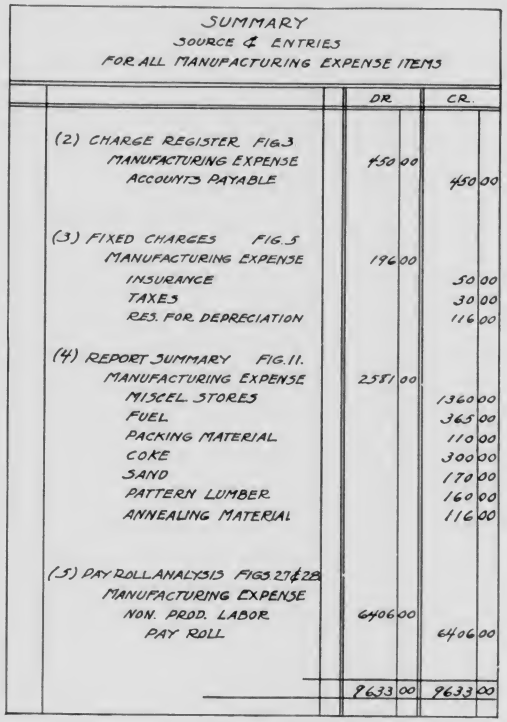
THE A.B.C. FOUNDRY CO
COALPORT PENN

ACC'T NO.	ACCOUNT AND DESCRIPTION	DEPT NO.	AMOUNT
	PIG & SCRAP		
	COKE		
	FUEL		
	ANNEAL'G MATERIAL		
	SAND		
	PATTERN LUMBER		
	PACKING MATERIAL		
	MISCEL. STORES		
	FREIGHT ON NO.		
	PAY ROLL		
	MANUF'G EXPENSE:-		
	SELLING EXPENSE:-		
	SUNDRY ACCOUNTS:-		
	TOTAL		

Form 35.

From these summaries, Forms 5, 21, 31, 32, 34 and 35, all of the items of the Manufacturing Expense may be readily picked off and charged to the correct department. Form 36 summarizes all these entries.

52. Why the Expense Analysis Is Valuable.—Now as to how the expense analysis operates. Remember that its primary reason for being lies in the fact that each department which does work on the product may require a separate measure for charging its overhead into the product which passes through it. In one department the hours of productive labor put in on the product may be the fair measure of the overhead which the product must bear.



SUMMARY
SOURCE & ENTRIES
FOR ALL MANUFACTURING EXPENSE ITEMS

	DR.		CR.	
(2) CHARGE REGISTER FIG. 3				
MANUFACTURING EXPENSE	450	00		
ACCOUNTS PAYABLE			450	00
(3) FIXED CHARGES FIG. 5				
MANUFACTURING EXPENSE	196	00		
INSURANCE			50	00
TAXES			30	00
RES. FOR DEPRECIATION			116	00
(4) REPORT SUMMARY FIG. 11.				
MANUFACTURING EXPENSE	2581	00		
MISCEL. STORES			1360	00
FUEL			365	00
PACKING MATERIAL			110	00
COKE			300	00
SAND			170	00
PATTERN LUMBER			160	00
ANNEALING MATERIAL			116	00
(5) PAY ROLL ANALYSIS FIGS. 27 & 28				
MANUFACTURING EXPENSE				
NON. PROD. LABOR	6406	00		
PAY ROLL			6406	00
	9633	00	9633	00

FORM 36.

In another department the weight of the casting may be the only proper measure, and so on. Therefore it is necessary to gather the overhead for each department separately in order that it may be applied to the product separately.

But we have seen that not all of the departments in the plant do productive work in getting out the casting. There

are such departments as the Power Department which serve the productive departments, and the expense of which must ultimately get into the final cost of every casting made. We call these contributory departments. Plainly it is not feasible to measure directly the amount of power, and hence of power cost, which each casting has used. But we can measure closely the amount of power each productive department uses. So the expense of each contributory department is first gathered and then passed on to the productive departments in the proportion that each productive department benefits from the service of the contributory department. Ultimately the productive departments absorb all of the expense of all of the contributory departments. And at last the total expense of the productive departments is absorbed by the castings. This, in brief, is the principle underlying the departmental expense analysis method of spreading overhead.

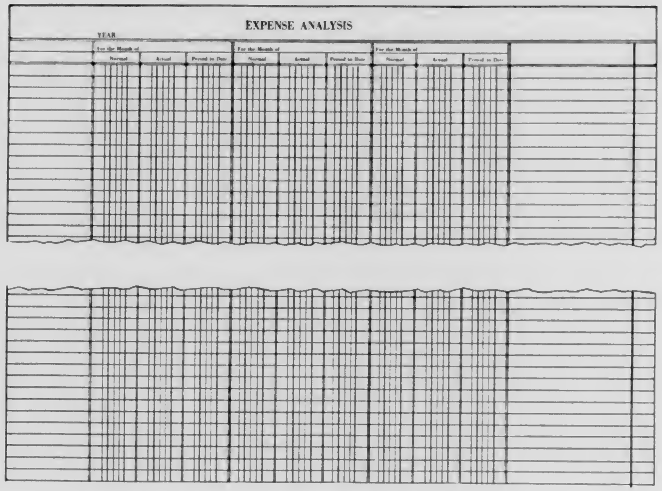
It has been found, however, that by drawing up the expense analyses in proper form they can be made to give information on operations which is invaluable as a means to control the manufacturing, to spot inefficiencies, and to suggest economies.

53. A Sample Expense Analysis.—The expense analysis sheet which is actually used in the operation of any foundry cost system, is shown as Form 37. It provides columns for the current month's expense and for the expense for the period to date. This set of columns is repeated for succeeding months so that constant comparison can be made to determine abnormal operating expenses and to correct bad tendencies quickly.

For the detailed analyses for the fifteen departments described in this book, a condensed form of analysis sheet has been used merely as a matter of convenience and to save space.

Let us now turn for a moment to the controlling figures entered in the general ledger accounts and see how these amounts are distributed to the departments. The first entries came from the summary of the charge register, Form 34, and are seen to be chargeable to departments 5 and 6. The total, $450, checks with the entry made to the general ledger account. Turning to departments 5 and 6 of the analysis (Forms 37–5 and 37–6) it is seen that these expenses have been posted.

The fixed charges from Form 5 are then distributed to the departments and checked with the total, $196, which has been debited to Manufacturing Expense.



EXPENSE ANALYSIS

YEAR

	For the Month of			For the Month of			For the Month of				
	Normal	Actual	Period to Date	Normal	Actual	Period to Date	Normal	Actual	Period to Date		

Form 37.

From the analysis of supplies used, Form 21, further entries to various departmental expense are obtained. The total, $2,581, agrees with the amounts debited to the Manufacturing Expense Account.

In the same way the items of labor are obtained from the payroll analysis, Forms 31 or 32. The sum of all the labor items are checked against the credits to the Payroll Account in the general ledger. This will check with the debit of $7,550 to the Goods in Process Account, and the debit of $6,406 to the Manufacturing Expense Account.

In this way are entered on the expense analysis sheets and proved with the general ledger, all of the items of Manufacturing Expense.

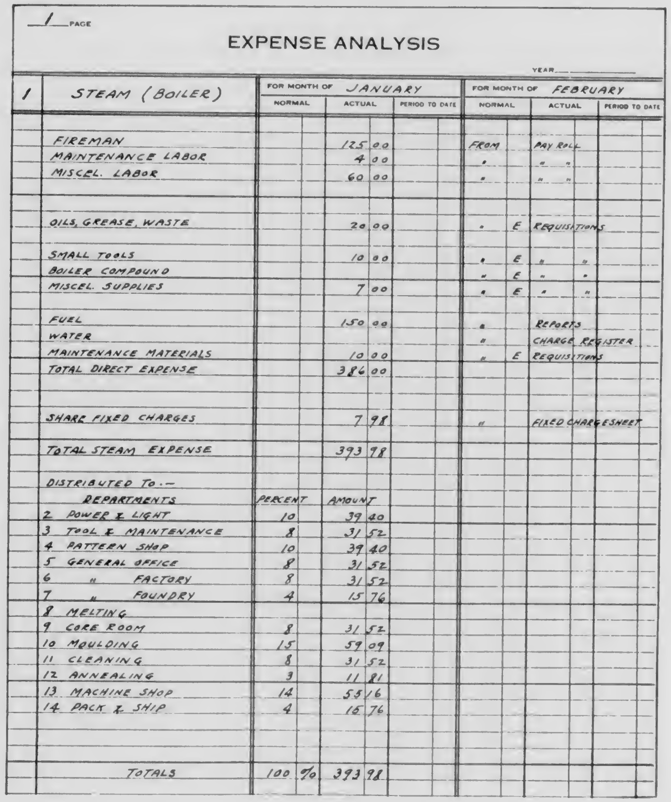
54. Listing the Expense Items.—The expenses listed for each department start with the salary of the foreman or superintendent, the miscellaneous non-productive labor in such detail as may be required, and the supplies itemized which represent the largest expenditures. The sum of these items is the total direct expense for which the department head may be held strictly responsible since he can, to a degree, control it. Then come the shares of expense of the contributory departments from which that department benefits, and the share of fixed charges. Opposite each labor and expense item is a notation indicating its source. This will serve as a guide to the reader in following the method as it is described.

It is well to mention that the items listed on the expense analysis will not necessarily be the same for all foundries. These shown on the analysis we have set up in this book may, however, be considered typical.

No two foundries are arranged quite the same; consequently an item of expense that may be important for one foundry may be a minor item to another. For instance, for the small foundry it may be sufficient to group several items of expense such as "oils, grease and waste," while in a large foundry the consumption of each may be so large that for close control it will be desirable to show each item by itself. As a rule, do not undertake the extra clerical expense of minute subdivision if the item is not large enough to suggest that worth-while economies may be effected by the closer control.

We shall now take up in turn each department of the plant; show how its expense is gathered on the expense analysis and how the total expense may be correctly passed on to other departments or spread onto the product.

55. The Steam Department.—The first is the contributory department which we call "Steam." It comprises the boiler room. The expenses are gathered on the expense analysis sheet in the way which has already been described. The problem we are interested in now is to distribute this expense. The Steam Department supplies steam to the power plant for power purposes and to the other departments for heating, and in some instances for process work. Certain departments, however, receive no direct heat; they depend upon the by-product heat from the



1 PAGE

EXPENSE ANALYSIS

YEAR____

		FOR MONTH OF JANUARY			FOR MONTH OF FEBRUARY		
1	STEAM (BOILER)	NORMAL	ACTUAL	PERIOD TO DATE	NORMAL	ACTUAL	PERIOD TO DATE
	FIREMAN		125 00		FROM	PAY ROLL	
	MAINTENANCE LABOR		4 00		"	" "	
	MISCEL. LABOR		60 00		"	" "	
	OILS, GREASE, WASTE		20 00		" E	REQUISITIONS	
	SMALL TOOLS		10 00		" E	" "	
	BOILER COMPOUND				" E	" "	
	MISCEL. SUPPLIES		7 00		" E	" "	
	FUEL		150 00		"	REPORTS	
	WATER				"	CHARGE REGISTER	
	MAINTENANCE MATERIALS		10 00		" E	REQUISITIONS	
	TOTAL DIRECT EXPENSE		386 00				
	SHARE FIXED CHARGES		7 98		"	FIXED CHARGESHEET	
	TOTAL STEAM EXPENSE		393 98				
	DISTRIBUTED TO.—						
	DEPARTMENTS	PERCENT	AMOUNT				
	2 POWER & LIGHT	10	39 40				
	3 TOOL & MAINTENANCE	8	31 52				
	4 PATTERN SHOP	10	39 40				
	5 GENERAL OFFICE	8	31 52				
	6 " FACTORY	8	31 52				
	7 " FOUNDRY	4	15 76				
	8 MELTING						
	9 CORE ROOM	8	31 52				
	10 MOULDING	15	59 09				
	11 CLEANING	8	31 52				
	12 ANNEALING	3	11 81				
	13 MACHINE SHOP	14	55 16				
	14 PACK & SHIP	4	15 76				
	TOTALS	100 %	393 98				

FORM 37-1.

processes. We have frequently said that devising a correct cost system is an engineering problem. Arriving at a basis for the distribution of the steam expense is an excellent example of this.

The foundry may be heated with live steam with the engines exhausting to atmosphere. This, of course, is a wasteful method, but if it exists, as is sometimes the case, the amount of steam chargeable to power will be a much greater item than if the plant is heated with exhaust steam.

If the boiler is used for heating only, all steam is chargeable for this purpose. If the boiler is operated at high pressure to furnish steam for testing purposes, a reducing valve may be introduced in the heating lines in order to furnish low pressure heating. If steam is furnished to the engine for power, and the exhaust steam used for heating, the engine takes out, theoretically, only about 5 per cent of the heat. For practical purposes we use 10 per cent to cover the losses which occur from radiation and condensation in the piping and elsewhere.

Sometimes the power required to manufacture is small and the amount of exhaust steam delivered not sufficient to heat the plant. In this case enough additional steam for this purpose must be furnished direct. This may be necessary only during severe cold weather. Nevertheless these conditions determine the basis for distributing the expense of the department.

To begin with, we must know how much steam is used by the engines. To determine this, an evaporative test of the boilers and an indicated test of the engines may be made. Such a test recently made in one plant which uses the exhaust steam for heating, showed that the engine used about 60 per cent of the steam produced. Since the engine practically turns only 10 per cent of the heat in the steam into power and passes on the rest of the heat, it is apparent that only 6 per cent of the Steam Department's expense can be charged to the Light and Power Department. The other 94 per cent must be distributed direct to other departments.

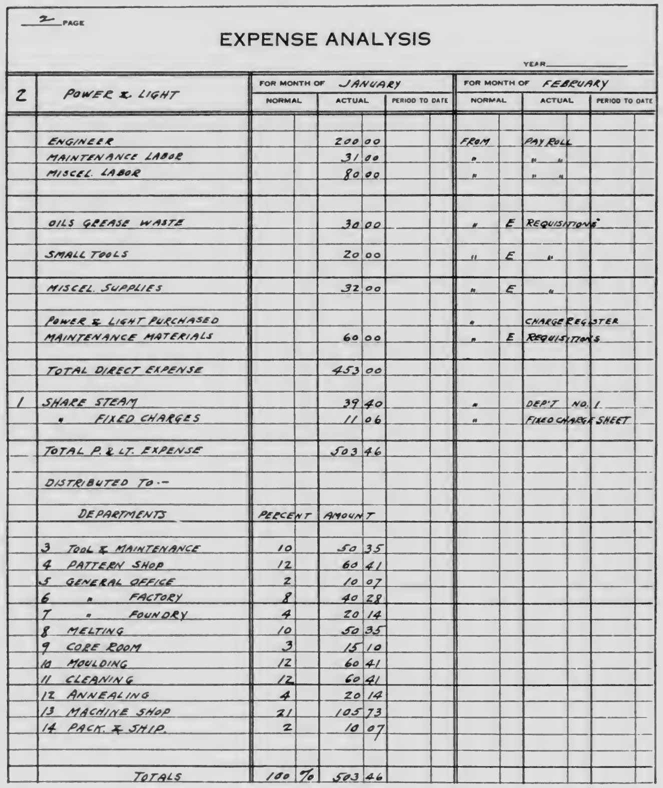
56. Spreading the Expense for Steam.—The amount of steam required to heat any department depends upon many factors. The cubical contents, considering the exposed wall, glass surface and type of construction, should be the basis for determining the required heat. If the buildings are so constructed that the volume of each department is in fairly uniform proportion to the floor space, and the type of construction of all buildings is the same, the floor space may be used as a basis of distribution, considering of course, those departments which do not require direct heating. An alternative method is to use the square feet of radiation and thus arrive at a percentage basis. No hard and fast rule can be laid down. The method to be used must be decided upon only after a thorough examination of the entire heating installation and in conjunction with all other equipment which makes use of steam. The one chosen must be the one which will be most accurate.

Usually the power house requires, in addition to the 6 per cent of steam for power, about 4 per cent for heat, making a total of 10 per cent chargeable to power and light. By some one of the possible methods it will be decided how much steam is used by the other departments. Let us say that they have been found to be as follows:

No.	Department	Per cent	Amount
2	Power and Light	10	$39.40
3	Tool and Maintenance	8	31.52
4	Pattern Shop	10	39.40
5	General Office	8	31.52
6	General Factory	8	31.52
etc.			

In that way the total expense of the steam department for the month—$393.98—is charged to the proper departments by posting the correct amount on their expense analysis sheets opposite the item "Share of Steam."

The proportions given may serve very well for, say, the six months ending April 30. In some of the departments during the remaining six months little or no steam may be required. It may even be advisable to set a normal consumption of steam for heating for each month.



2 PAGE

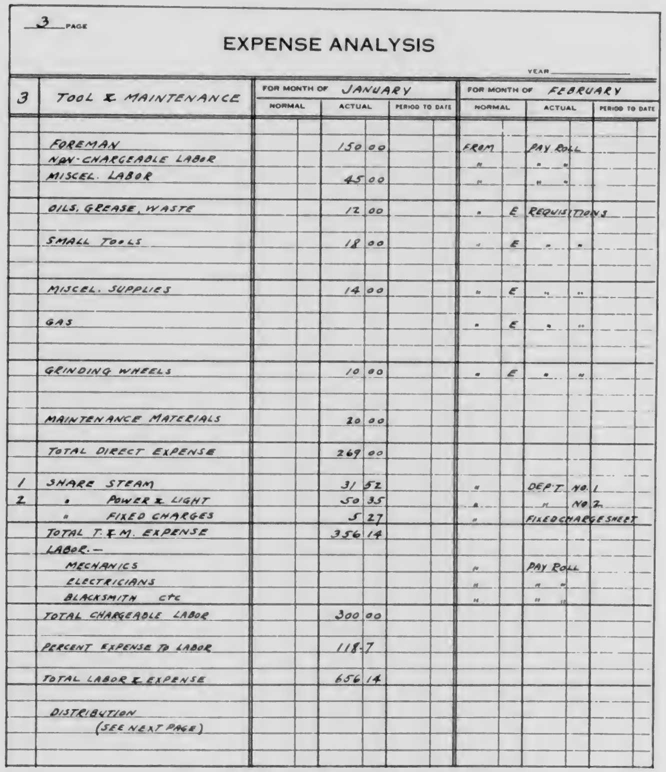
EXPENSE ANALYSIS

YEAR

		FOR MONTH OF JANUARY			FOR MONTH OF FEBRUARY		
2	POWER & LIGHT	NORMAL	ACTUAL	PERIOD TO DATE	NORMAL	ACTUAL	PERIOD TO DATE
	ENGINEER		200 00		FROM	PAY ROLL	
	MAINTENANCE LABOR		31 00		"	" "	
	MISCEL. LABOR		80 00		"	" "	
	OILS GREASE WASTE		30 00		" E	REQUISITIONS	
	SMALL TOOLS		20 00		" E	"	
	MISCEL. SUPPLIES		32 00		" E	"	
	POWER & LIGHT PURCHASED				"	CHARGE REGISTER	
	MAINTENANCE MATERIALS		60 00		" E	REQUISITIONS	
	TOTAL DIRECT EXPENSE		453 00				
1	SHARE STEAM		39 40		"	DEP'T NO. 1	
	" FIXED CHARGES		11 06		"	FIXED CHARGE SHEET	
—	TOTAL P. & LT. EXPENSE		503 46				
	DISTRIBUTED TO:—						
	DEPARTMENTS	PERCENT	AMOUNT				
	3 TOOL & MAINTENANCE	10	50 35				
	4 PATTERN SHOP	12	60 41				
	5 GENERAL OFFICE	2	10 07				
	6 " FACTORY	8	40 28				
	7 " FOUNDRY	4	20 14				
	8 MELTING	10	50 35				
	9 CORE ROOM	3	15 10				
	10 MOULDING	12	60 41				
	11 CLEANING	12	60 41				
	12 ANNEALING	4	20 14				
	13 MACHINE SHOP	21	105 73				
	14 PACK. & SHIP.	2	10 07				
	TOTALS	100 %	503 46				

FORM 37–2.

57. The Power and Light Department.—The expense analysis for the Power and Light Department is shown as Form 37–2. Power and light are used by all departments of the plant, so a basis must be found for charging each department with its share of the power and light expense. The most accurate method is to meter the amount of current and air used by each department, but there are few foundries equipped with meters. Usually the accuracy gained by metering would not be worth the cost of the equipment.



3 PAGE

EXPENSE ANALYSIS

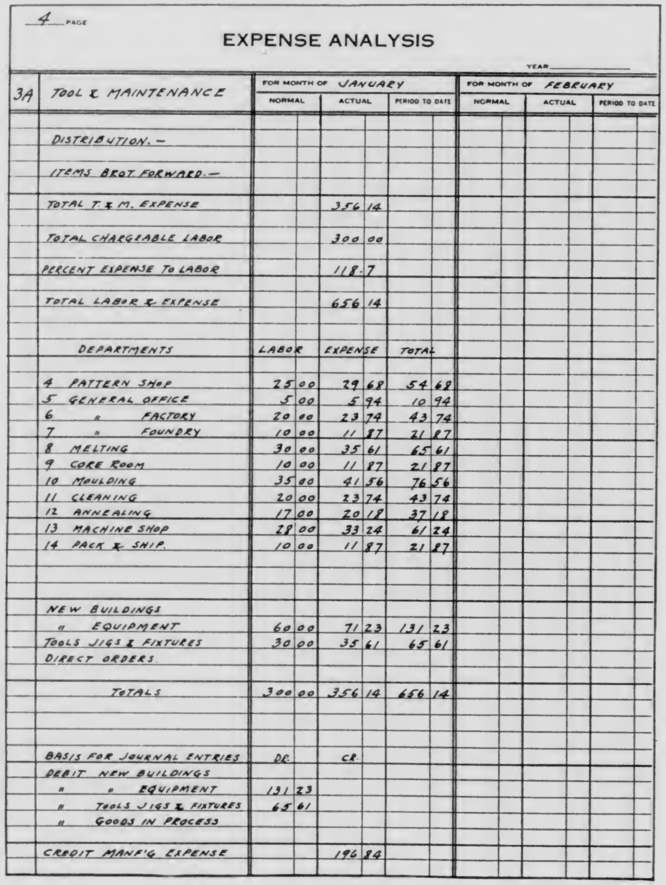
YEAR

3	TOOL & MAINTENANCE	FOR MONTH OF JANUARY			FOR MONTH OF FEBRUARY		
		NORMAL	ACTUAL	PERIOD TO DATE	NORMAL	ACTUAL	PERIOD TO DATE
	FOREMAN		150 00		FROM	PAY ROLL	
	NON-CHARGEABLE LABOR				"	" "	
	MISCEL. LABOR		45 00		"	" "	
	OILS, GREASE, WASTE		12 00		" E	REQUISITIONS	
	SMALL TOOLS		18 00		" E	" "	
	MISCEL. SUPPLIES		14 00		" E	" "	
	GAS				" E	" "	
	GRINDING WHEELS		10 00		" E	" "	
	MAINTENANCE MATERIALS		20 00				
	TOTAL DIRECT EXPENSE		269 00				
1	SHARE STEAM		31 52		"	DEP'T NO. 1	
2	" POWER & LIGHT		50 35		"	" NO. 2	
	" FIXED CHARGES		5 27		"	FIXED CHARGE SHEET	
	TOTAL T. & M. EXPENSE		356 14				
	LABOR.—						
	MECHANICS				"	PAY ROLL	
	ELECTRICIANS				"	" "	
	BLACKSMITH etc				"	" "	
	TOTAL CHARGEABLE LABOR		300 00				
	PERCENT EXPENSE TO LABOR		118.7				
	TOTAL LABOR & EXPENSE		656 14				
	DISTRIBUTION (SEE NEXT PAGE)						

FORM 37–3.

A complete power test of the foundry when operating at normal capacity may be a satisfactory substitute for

metering, if properly made by experienced engineers. Such a test should run for 24 hours, and be repeated three or four times in order to strike an average consumption for the departments under varying loads. When the horsepower consumed by each department is known it is expressed



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EXPENSE ANALYSIS

YEAR

3A	TOOL & MAINTENANCE	FOR MONTH OF JANUARY			FOR MONTH OF FEBRUARY		
		NORMAL	ACTUAL	PERIOD TO DATE	NORMAL	ACTUAL	PERIOD TO DATE
	DISTRIBUTION.—						
	ITEMS BROT. FORWARD.—						
	TOTAL T. & M. EXPENSE		356 14				
	TOTAL CHARGEABLE LABOR		300 00				
	PERCENT EXPENSE TO LABOR		118.7				
	TOTAL LABOR & EXPENSE		656 14				
	DEPARTMENTS	LABOR	EXPENSE	TOTAL			
	4 PATTERN SHOP	25 00	29 68	54 68			
	5 GENERAL OFFICE	5 00	5 94	10 94			
	6 " FACTORY	20 00	23 74	43 74			
	7 " FOUNDRY	10 00	11 87	21 87			
	8 MELTING	30 00	35 61	65 61			
	9 CORE ROOM	10 00	11 87	21 87			
	10 MOULDING	35 00	41 56	76 56			
	11 CLEANING	20 00	23 74	43 74			
	12 ANNEALING	17 00	20 18	37 18			
	13 MACHINE SHOP	28 00	33 24	61 24			
	14 PACK & SHIP.	10 00	11 87	21 87			
	NEW BUILDINGS						
	" EQUIPMENT	60 00	71 23	131 23			
	TOOLS JIGS & FIXTURES	30 00	35 61	65 61			
	DIRECT ORDERS.						
	TOTALS	300 00	356 14	656 14			
	BASIS FOR JOURNAL ENTRIES	DR.	CR.				
	DEBIT NEW BUILDINGS						
	" " EQUIPMENT	131 23					
	" TOOLS JIGS & FIXTURES	65 61					
	" GOODS IN PROCESS						
	CREDIT MANF'G EXPENSE		196 84				

FORM 37–3*a*.

as a percentage of the total horsepower consumption of the entire factory and the power and light expense distributed to the departments on the basis. While these results will be reasonably accurate for the conditions under which the tests were made, they may soon become inaccurate with the change of manufacturing activities, which vary constantly. Therefore it is often best—in order to avoid frequent tests—to use other methods which serve the purpose equally well.

A method satisfactory in many cases is to base the departmental share of the Power and Light expense upon the power consumption rating given the various equipment and lighting units by their makers.

Before choosing any one of these methods a careful study of conditions and equipment should be made to determine which one is best suited to the particular foundry—accuracy and simplicity considered.

When the percentages have been determined they are tabulated on Form 38, subject to check from time to time, to meet changing conditions in equipment and power units.

For the typical foundry we are describing, we have assumed the percentages which are shown on the analysis, Form 37–3, and on the collection sheet, Form 38.

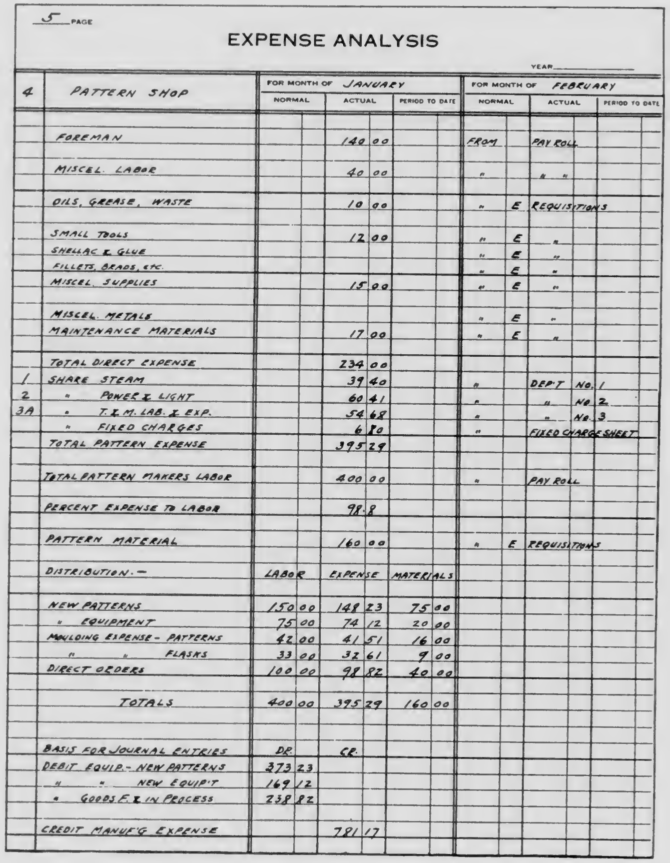
The total department expense for the month amounts to $503.46 of which,

Tool and Maintenance Department is charged with 10 per cent.....	$50.35
Pattern Shop Department is charged with 12 per cent...........	60.41
General Office Department is charged with 2 per cent............	10.07
General Factory Department is charged with 8 per cent..........	40.28

and so on, until the entire expense is accounted for. The sum of the percentages of course, equals 100 per cent and the sum of the amounts chargeable to the various departments must equal the original sum, $503.46.

The amounts so determined are then distributed, by posting, to the expense analyses of the other departments.

58. The Tool and Maintenance Department.—Next we shall consider the expense of the Tool and Maintenance Department, which is distributed on a basis entirely different from that used in the previously described departments. The expense is made up the same as for the others, but includes also the share of the distributed expense from "Steam" and "Power and Light" as well as a share of the Fixed Charge.



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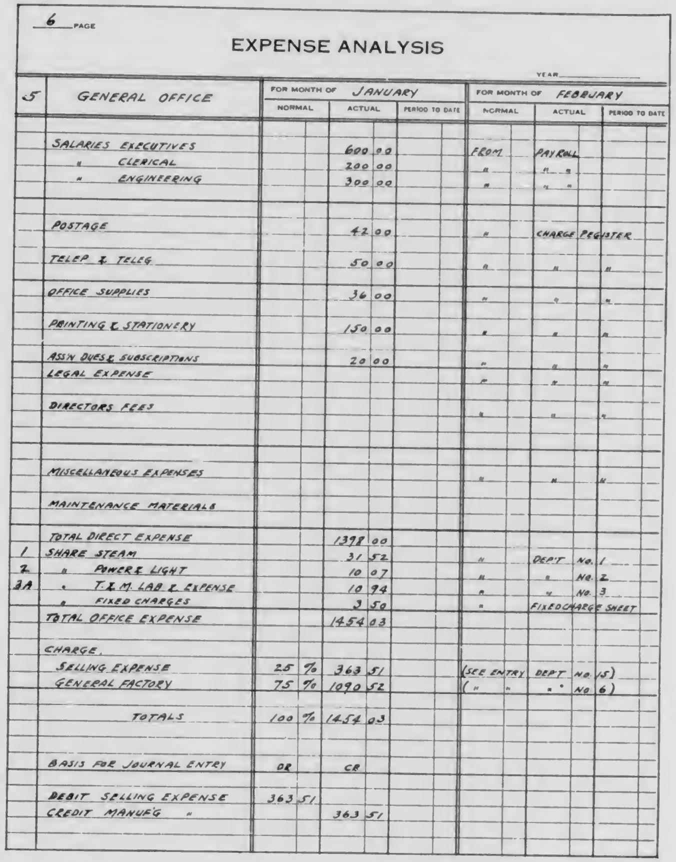
EXPENSE ANALYSIS

YEAR________

4	PATTERN SHOP	FOR MONTH OF JANUARY			FOR MONTH OF FEBRUARY		
		NORMAL	ACTUAL	PERIOD TO DATE	NORMAL	ACTUAL	PERIOD TO DATE
	FOREMAN		140 00		FROM	PAY ROLL	
	MISCEL. LABOR		40 00		"	" "	
	OILS, GREASE, WASTE		10 00		" E	REQUISITIONS	
	SMALL TOOLS		12 00		" E	"	
	SHELLAC & GLUE				" E	"	
	FILLETS, BRADS, ETC.				" E	"	
	MISCEL. SUPPLIES		15 00		" E	"	
	MISCEL. METALS				" E	"	
	MAINTENANCE MATERIALS		17 00		" E	"	
	TOTAL DIRECT EXPENSE		234 00				
1	SHARE STEAM		39 40		"	DEP'T No. 1	
2	" POWER & LIGHT		60 41		"	" No. 2	
3A	" T. & M. LAB. & EXP.		54 68		"	" No. 3	
	" FIXED CHARGES		6 80		"	FIXED CHARGE SHEET	
	TOTAL PATTERN EXPENSE		395 29				
	TOTAL PATTERN MAKERS LABOR		400 00		"	PAY ROLL	
	PERCENT EXPENSE TO LABOR		98.8				
	PATTERN MATERIAL		160 00		" E	REQUISITIONS	
	DISTRIBUTION.—	LABOR	EXPENSE	MATERIALS			
	NEW PATTERNS	150 00	148 23	75 00			
	" EQUIPMENT	75 00	74 12	20 00			
	MOULDING EXPENSE - PATTERNS	42 00	41 51	16 00			
	" " FLASKS	33 00	32 61	9 00			
	DIRECT ORDERS	100 00	98 82	40 00			
	TOTALS	400 00	395 29	160 00			
	BASIS FOR JOURNAL ENTRIES	DR.	CR.				
	DEBIT EQUIP. - NEW PATTERNS	373 23					
	" " NEW EQUIP'T	169 12					
	" GOODS F. & IN PROCESS	238 82					
	CREDIT MANUF'G EXPENSE		781 17				

Form 37–4.

The total chargeable labor is shown separately although it is considered as expense, or non-productive labor, when making up the factory payroll. It includes the mechanics, electricians, blacksmith, etc.



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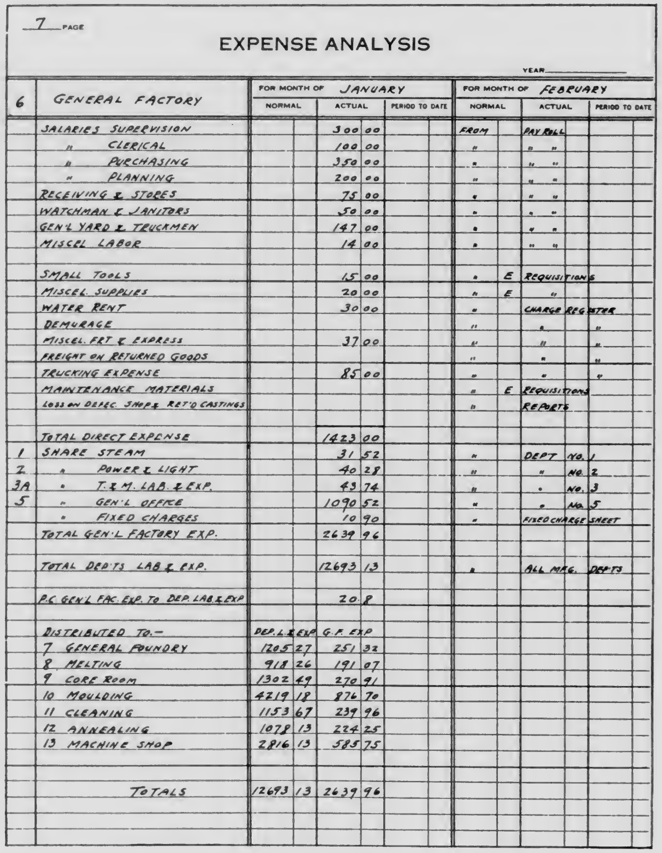
EXPENSE ANALYSIS

YEAR ______

5	GENERAL OFFICE	FOR MONTH OF JANUARY			FOR MONTH OF FEBRUARY		
		NORMAL	ACTUAL	PERIOD TO DATE	NORMAL	ACTUAL	PERIOD TO DATE
	SALARIES EXECUTIVES		600 00		FROM	PAY ROLL	
	" CLERICAL		200 00		"	" "	
	" ENGINEERING		300 00		"	" "	
	POSTAGE		42 00		"	CHARGE REGISTER	
	TELEP & TELEG		50 00		"	"	"
	OFFICE SUPPLIES		36 00		"	"	"
	PRINTING & STATIONERY		150 00		"	"	"
	ASS'N DUES & SUBSCRIPTIONS		20 00		"	"	"
	LEGAL EXPENSE				"	"	"
	DIRECTORS FEES				"	"	"
	MISCELLANEOUS EXPENSES				"	"	"
	MAINTENANCE MATERIALS						
	TOTAL DIRECT EXPENSE		1398 00				
1	SHARE STEAM		31 52		"	DEP'T NO. 1	
2	" POWER & LIGHT		10 07		"	" NO. 2	
3A	" T. & M. LAB & EXPENSE		10 94		"	" NO. 3	
	" FIXED CHARGES		3 50		"	FIXED CHARGE SHEET	
	TOTAL OFFICE EXPENSE		1454 03				
	CHARGE.						
	SELLING EXPENSE	25 %	363 51		(SEE ENTRY	DEPT NO. 15)	
	GENERAL FACTORY	75 %	1090 52		(" "	" " NO 6)	
	TOTALS	100 %	1454 03				
	BASIS FOR JOURNAL ENTRY	DR	CR				
	DEBIT SELLING EXPENSE	363 51					
	CREDIT MANUF'G "		363 51				

FORM 37–5.

This department takes care of the general maintenance and repairs, new construction and making of new equipment for the entire plant. It is obvious that it will have maintenance and repair work to do for itself as well as for other departments, the labor and material for which must be considered as a part of the department's expense. This labor is shown as non-chargeable labor. The miscellaneous labor item includes any idle time of the mechanics, when



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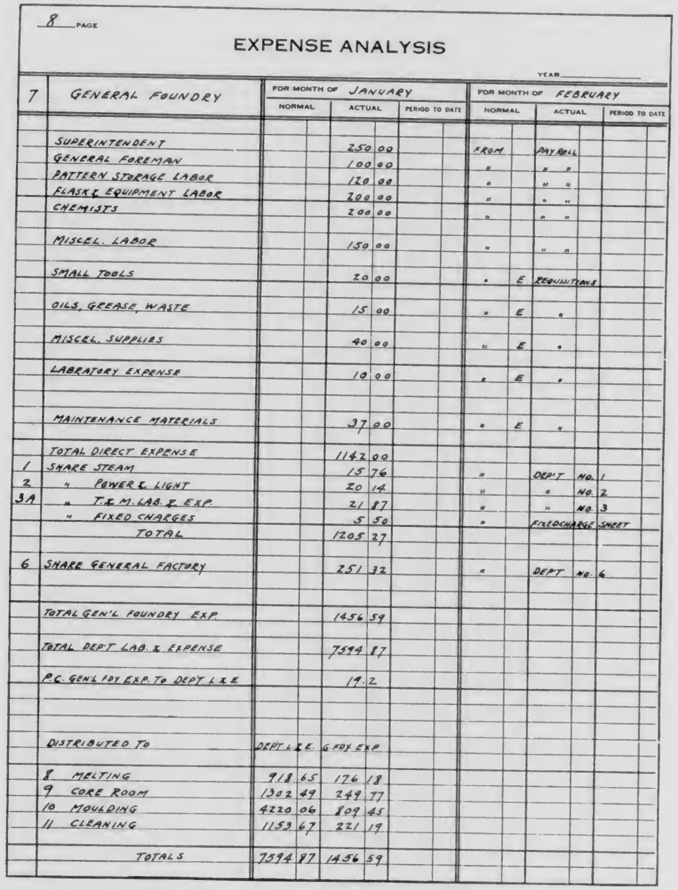
EXPENSE ANALYSIS

YEAR ______

6	GENERAL FACTORY	FOR MONTH OF JANUARY			FOR MONTH OF FEBRUARY		
		NORMAL	ACTUAL	PERIOD TO DATE	NORMAL	ACTUAL	PERIOD TO DATE
	SALARIES SUPERVISION		300 00		FROM	PAY ROLL	
	" CLERICAL		100 00		"	" "	
	" PURCHASING		350 00		"	" "	
	" PLANNING		200 00		"	" "	
	RECEIVING & STORES		75 00		"	" "	
	WATCHMAN & JANITORS		50 00		"	" "	
	GEN'L YARD & TRUCKMEN		147 00		"	" "	
	MISCEL LABOR		14 00		"	" "	
	SMALL TOOLS		15 00		" E	REQUISITIONS	
	MISCEL. SUPPLIES		20 00		" E	"	
	WATER RENT		30 00		"	CHARGE REGISTER	
	DEMURAGE				"	"	"
	MISCEL. FRT & EXPRESS		37 00		"	"	"
	FREIGHT ON RETURNED GOODS				"	"	"
	TRUCKING EXPENSE		85 00		"	"	"
	MAINTENANCE MATERIALS				" E	REQUISITIONS	
	LOSS ON DEFEC. SHOP & RET'D CASTINGS				"	REPORTS	
	TOTAL DIRECT EXPENSE		1423 00				
1	SHARE STEAM		31 52		"	DEPT NO. 1	
2	" POWER & LIGHT		40 28		"	" NO. 2	
3A	" T. & M. LAB. & EXP.		43 74		"	" NO. 3	
5	" GEN'L OFFICE		1090 52		"	" NO. 5	
	" FIXED CHARGES		10 90		"	FIXED CHARGE SHEET	
	TOTAL GEN'L FACTORY EXP.		2639 96				
	TOTAL DEP'TS LAB & EXP.		12693 13		"	ALL MFG. DEP'TS	
	P.C. GEN'L FAC. EXP. TO DEP. LAB & EXP		20.8				
	DISTRIBUTED TO.—	DEP. L. & EXP	G. F. EXP				
	7 GENERAL FOUNDRY	1205 27	251 32				
	8 MELTING	918 26	191 07				
	9 CORE ROOM	1302 49	270 91				
	10 MOULDING	4219 18	876 70				
	11 CLEANING	1153 67	239 96				
	12 ANNEALING	1078 13	224 25				
	13 MACHINE SHOP	2816 13	585 75				
	TOTALS	12693 13	2639 96				

FORM 37–6.

they are not doing chargeable work, together with any general help which the department may require. The repair materials are shown as maintenance materials.



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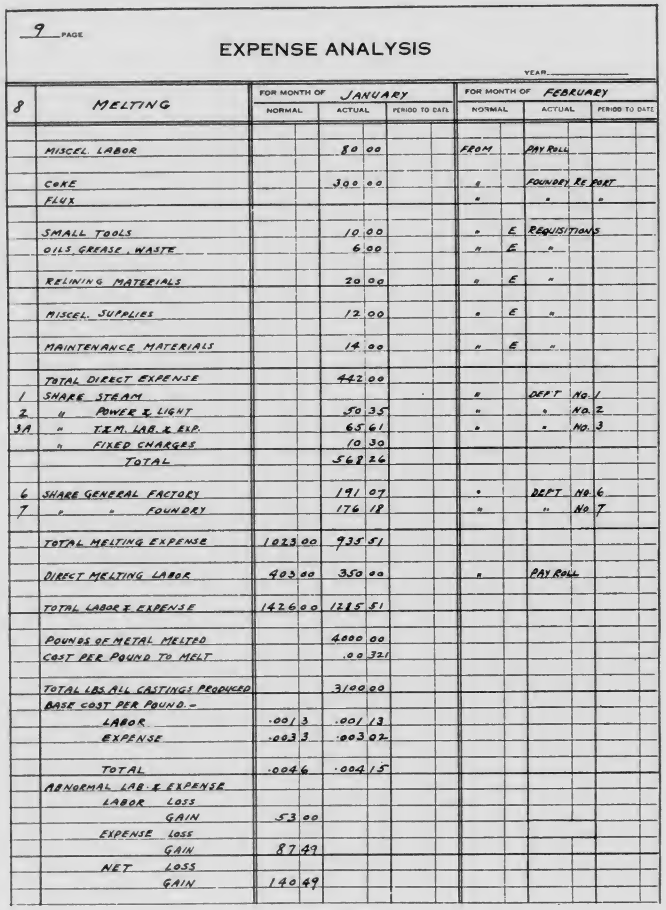
EXPENSE ANALYSIS

YEAR________

7	GENERAL FOUNDRY	FOR MONTH OF JANUARY			FOR MONTH OF FEBRUARY		
		NORMAL	ACTUAL	PERIOD TO DATE	NORMAL	ACTUAL	PERIOD TO DATE
	SUPERINTENDENT		250 00		FROM	PAY ROLL	
	GENERAL FOREMAN		100 00		"	" "	
	PATTERN STORAGE LABOR		120 00		"	" "	
	FLASK & EQUIPMENT LABOR		200 00		"	" "	
	CHEMISTS		200 00		"	" "	
	MISCEL. LABOR		150 00		"	" "	
	SMALL TOOLS		20 00		" E	REQUISITIONS	
	OILS, GREASE, WASTE		15 00		" E	"	
	MISCEL. SUPPLIES		40 00		" E	"	
	LABRATORY EXPENSE		10 00		" E	"	
	MAINTENANCE MATERIALS		37 00		" E	"	
	TOTAL DIRECT EXPENSE		1142 00				
1	SHARE STEAM		15 76		"	DEP'T NO. 1	
2	" POWER & LIGHT		20 14		"	" NO. 2	
3A	" T. & M. LAB. & EXP.		21 87		"	" NO. 3	
	" FIXED CHARGES		5 50		"	FIXED CHARGE SHEET	
	TOTAL		1205 27				
6	SHARE GENERAL FACTORY		251 32		"	DEPT NO. 6	
	TOTAL GEN'L FOUNDRY EXP.		1456 59				
	TOTAL DEP'T LAB. & EXPENSE		7594 87				
	P.C. GEN'L FDY EXP. TO DEPT L & E		19.2				
	DISTRIBUTED TO	DEPT L & E.	G FDY EXP				
	8 MELTING	918 65	176 18				
	9 CORE ROOM	1302 49	249 77				
	10 MOULDING	4220 06	809 45				
	11 CLEANING	1153 67	221 19				
	TOTALS	7594 87	1456 59				

Form 37-7.

59. Spreading the Expense.—When maintenance labor is required for repairs to the equipment in the Steam Department, and to Power and Light, it is transferred direct to these departments and not included with the labor totals of the Tool and Maintenance Departments.



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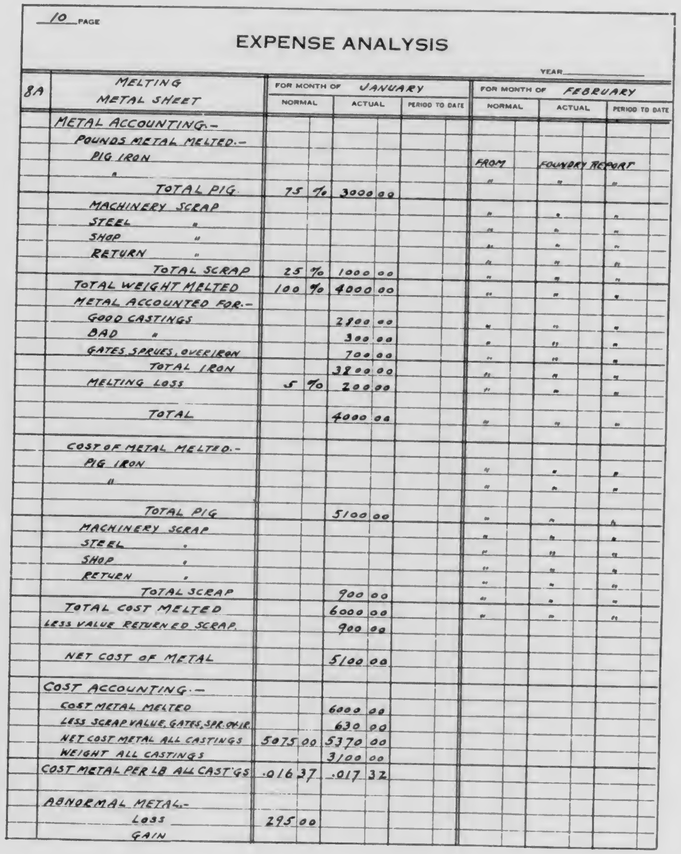
EXPENSE ANALYSIS

YEAR________

8	MELTING	FOR MONTH OF JANUARY			FOR MONTH OF FEBRUARY		
		NORMAL	ACTUAL	PERIOD TO DATE	NORMAL	ACTUAL	PERIOD TO DATE
	MISCEL. LABOR		80 00		FROM	PAY ROLL	
	COKE		300 00		"	FOUNDRY REPORT	
	FLUX				"	"	"
	SMALL TOOLS		10 00		" E	REQUISITIONS	
	OILS, GREASE, WASTE		6 00		" E	"	
	RELINING MATERIALS		20 00		" E	"	
	MISCEL. SUPPLIES		12 00		" E	"	
	MAINTENANCE MATERIALS		14 00		" E	"	
	TOTAL DIRECT EXPENSE		442 00				
1	SHARE STEAM				"	DEP'T NO. 1	
2	" POWER & LIGHT		50 35		"	" NO. 2	
3A	" T. & M. LAB. & EXP.		65 61		"	" NO. 3	
	" FIXED CHARGES		10 30				
	TOTAL		568 26				
6	SHARE GENERAL FACTORY		191 07		"	DEPT NO. 6	
7	" " FOUNDRY		176 18		"	" NO. 7	
	TOTAL MELTING EXPENSE	1023 00	935 51				
	DIRECT MELTING LABOR	403 00	350 00		"	PAY ROLL	
	TOTAL LABOR & EXPENSE	1426 00	1285 51				
	POUNDS OF METAL MELTED		4000 00				
	COST PER POUND TO MELT		.00 321				
	TOTAL LBS. ALL CASTINGS PRODUCED		3100 00				
	BASE COST PER POUND.—						
	LABOR	.001 3	.001 13				
	EXPENSE	.003 3	.003 02				
	TOTAL	.004 6	.004 15				
	ABNORMAL LAB. & EXPENSE						
	LABOR LOSS						
	GAIN	53 00					
	EXPENSE LOSS						
	GAIN	87 49					
	NET LOSS						
	GAIN	140 49					

Form 37-8.



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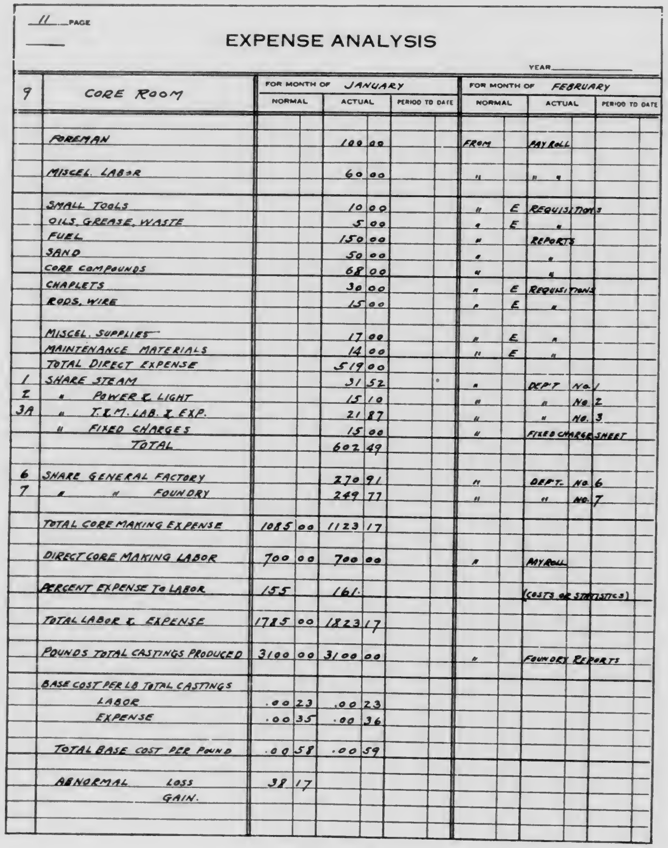
EXPENSE ANALYSIS

YEAR

8A	MELTING METAL SHEET	FOR MONTH OF JANUARY			FOR MONTH OF FEBRUARY		
		NORMAL	ACTUAL	PERIOD TO DATE	NORMAL	ACTUAL	PERIOD TO DATE
	METAL ACCOUNTING.—						
	POUNDS METAL MELTED.—						
	PIG IRON				FROM	FOUNDRY REPORT	
	"				"	"	"
	TOTAL PIG	75 %	3000 00				
	MACHINERY SCRAP				"	"	"
	STEEL "				"	"	"
	SHOP "				"	"	"
	RETURN "				"	"	"
	TOTAL SCRAP	25 %	1000 00		"	"	"
	TOTAL WEIGHT MELTED	100 %	4000 00		"	"	"
	METAL ACCOUNTED FOR.—						
	GOOD CASTINGS		2800 00		"	"	"
	BAD "		300 00		"	"	"
	GATES, SPRUES, OVERIRON		700 00		"	"	"
	TOTAL IRON		3800 00		"	"	"
	MELTING LOSS	5 %	200 00		"	"	"
	TOTAL		4000 00		"	"	"
	COST OF METAL MELTED.—						
	PIG IRON				"	"	"
	"				"	"	"
	TOTAL PIG		5100 00		"	"	"
	MACHINERY SCRAP				"	"	"
	STEEL "				"	"	"
	SHOP "				"	"	"
	RETURN "				"	"	"
	TOTAL SCRAP		900 00		"	"	"
	TOTAL COST MELTED		6000 00		"	"	"
	LESS VALUE RETURNED SCRAP.		900 00				
	NET COST OF METAL		5100 00				
	COST ACCOUNTING.—						
	COST METAL MELTED		6000 00				
	LESS SCRAP VALUE, GATES, SPR. OV. IR.		630 00				
	NET COST METAL ALL CASTINGS	5075 00	5370 00				
	WEIGHT ALL CASTINGS		3100 00				
	COST METAL PER LB ALL CAST'GS	.016 37	.017 32				
	ABNORMAL METAL.—						
	LOSS	295 00					
	GAIN						

FORM 37–8a.



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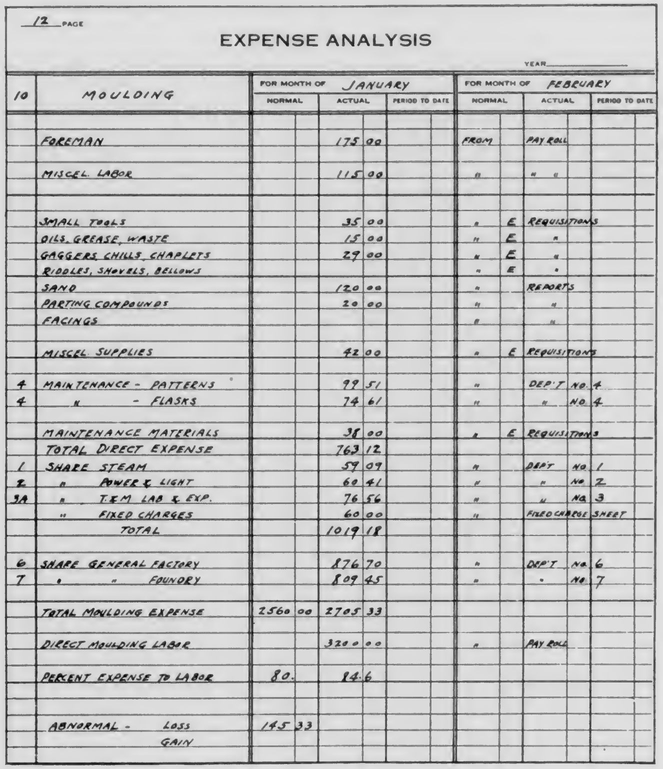
EXPENSE ANALYSIS

YEAR

9	CORE ROOM	FOR MONTH OF JANUARY			FOR MONTH OF FEBRUARY		
		NORMAL	ACTUAL	PERIOD TO DATE	NORMAL	ACTUAL	PERIOD TO DATE
	FOREMAN		100 00		FROM	PAY ROLL	
	MISCEL. LABOR		60 00		"	" "	
	SMALL TOOLS		10 00		" E	REQUISITIONS	
	OILS, GREASE, WASTE		5 00		" E	"	
	FUEL		150 00		"	REPORTS	
	SAND		50 00		"	"	
	CORE COMPOUNDS		68 00		"	"	
	CHAPLETS		30 00		" E	REQUISITIONS	
	RODS, WIRE		15 00		" E	"	
	MISCEL. SUPPLIES		17 00		" E	"	
	MAINTENANCE MATERIALS		14 00		" E	"	
	TOTAL DIRECT EXPENSE		519 00				
1	SHARE STEAM		31 52		"	DEPT NO. 1	
2	" POWER & LIGHT		15 10		"	" NO. 2	
3A	" T. & M. LAB. & EXP.		21 87		"	" NO. 3	
	" FIXED CHARGES		15 00		"	FIXED CHARGE SHEET	
	TOTAL		602 49				
6	SHARE GENERAL FACTORY		270 91		"	DEPT. NO. 6	
7	" " FOUNDRY		249 77		"	" NO. 7	
	TOTAL CORE MAKING EXPENSE	1085 00	1123 17				
	DIRECT CORE MAKING LABOR	700 00	700 00		"	PAYROLL	
	PERCENT EXPENSE TO LABOR	155	161.			(COSTS OR STATISTICS)	
	TOTAL LABOR & EXPENSE	1785 00	1823 17				
	POUNDS TOTAL CASTINGS PRODUCED	3100 00	3100 00		"	FOUNDRY REPORTS	
	BASE COST PER LB TOTAL CASTINGS						
	LABOR	.00 23	.00 23				
	EXPENSE	.00 35	.00 36				
	TOTAL BASE COST PER POUND	.00 58	.00 59				
	ABNORMAL LOSS	38 17					
	GAIN.						

FORM 37–9.



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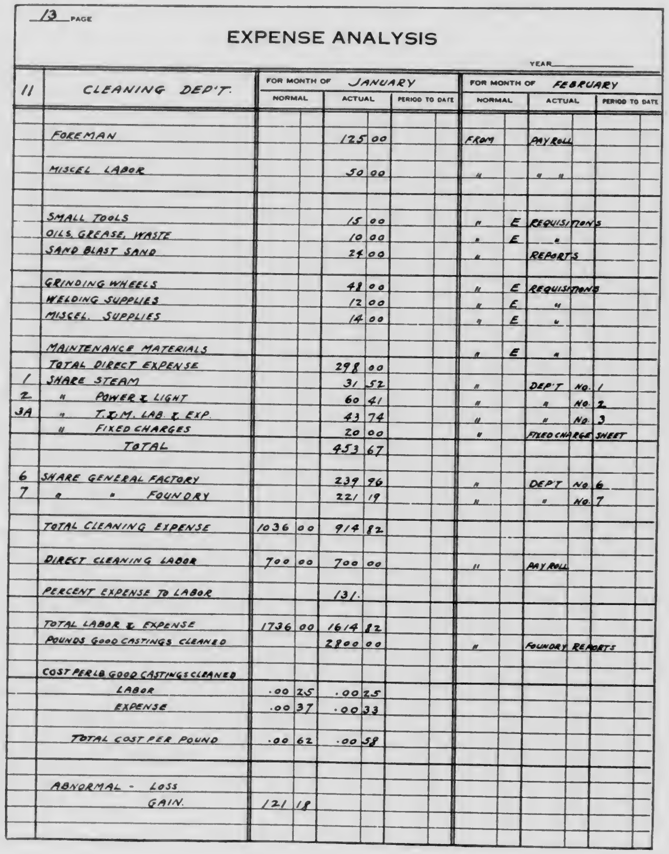
EXPENSE ANALYSIS

YEAR

10	MOULDING	FOR MONTH OF JANUARY			FOR MONTH OF FEBRUARY		
		NORMAL	ACTUAL	PERIOD TO DATE	NORMAL	ACTUAL	PERIOD TO DATE
	FOREMAN		175 00		FROM	PAY ROLL	
	MISCEL. LABOR		115 00		"	" "	
	SMALL TOOLS		35 00		" E	REQUISITIONS	
	OILS, GREASE, WASTE		15 00		" E	"	
	GAGGERS, CHILLS, CHAPLETS		29 00		" E	"	
	RIDDLES, SHOVELS, BELLOWS				" E	"	
	SAND		120 00		"	REPORTS	
	PARTING COMPOUNDS		20 00		"	"	
	FACINGS				"	"	
	MISCEL. SUPPLIES		42 00		" E	REQUISITIONS	
4	MAINTENANCE - PATTERNS		99 51		"	DEP'T NO.	4
4	" - FLASKS		74 61		"	" NO.	4
	MAINTENANCE MATERIALS		38 00		" E	REQUISITIONS	
	TOTAL DIRECT EXPENSE		763 12				
1	SHARE STEAM		59 09		"	DEP'T NO.	1
2	" POWER & LIGHT		60 41		"	" NO.	2
3A	" T. & M. LAB. & EXP.		76 56		"	" NO.	3
	" FIXED CHARGES		60 00		"	FIXED CHARGE	SHEET
	TOTAL		1019 18				
6	SHARE GENERAL FACTORY		876 70		"	DEP'T NO.	6
7	" " FOUNDRY		809 45		"	" NO.	7
	TOTAL MOULDING EXPENSE	2560 00	2705 33				
	DIRECT MOULDING LABOR		3200 00		"	PAY ROLL	
	PERCENT EXPENSE TO LABOR	80.	84.6				
	ABNORMAL - LOSS	145 33					
	GAIN						

Form 37-10.



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EXPENSE ANALYSIS

YEAR

11	CLEANING DEP'T.	FOR MONTH OF JANUARY			FOR MONTH OF FEBRUARY		
		NORMAL	ACTUAL	PERIOD TO DATE	NORMAL	ACTUAL	PERIOD TO DATE
	FOREMAN		125 00		FROM	PAY ROLL	
	MISCEL. LABOR		50 00		"	" "	
	SMALL TOOLS		15 00		" E	REQUISITIONS	
	OILS, GREASE, WASTE		10 00		" E	"	
	SAND BLAST SAND		24 00		"	REPORTS	
	GRINDING WHEELS		48 00		" E	REQUISITIONS	
	WELDING SUPPLIES		12 00		" E	"	
	MISCEL. SUPPLIES		14 00		" E	"	
	MAINTENANCE MATERIALS				" E	"	
	TOTAL DIRECT EXPENSE		298 00				
1	SHARE STEAM		31 52		"	DEP'T NO.	1
2	" POWER & LIGHT		60 41		"	" NO.	2
3A	" T. & M. LAB. & EXP.		43 74		"	" NO.	3
	" FIXED CHARGES		20 00		"	FIXED CHARGE	SHEET
	TOTAL		453 67				
6	SHARE GENERAL FACTORY		239 96		"	DEP'T NO.	6
7	" " FOUNDRY		221 19		"	" NO.	7
	TOTAL CLEANING EXPENSE	1036 00	914 82				
	DIRECT CLEANING LABOR	700 00	700 00		"	PAY ROLL	
	PERCENT EXPENSE TO LABOR		131.				
	TOTAL LABOR & EXPENSE	1736 00	1614 82				
	POUNDS GOOD CASTINGS CLEANED		2800 00		"	FOUNDRY REPORTS	
	COST PER LB GOOD CASTINGS CLEANED						
	LABOR	.00 25	.00 25				
	EXPENSE	.00 37	.00 33				
	TOTAL COST PER POUND	.00 62	.00 58				
	ABNORMAL - LOSS						
	GAIN.	121 18					

Form 37-11.

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EXPENSE ANALYSIS

YEAR________

12	ANNEALING	FOR MONTH OF JANUARY			FOR MONTH OF FEBRUARY		
		NORMAL	ACTUAL	PERIOD TO DATE	NORMAL	ACTUAL	PERIOD TO DATE
	FOREMAN		125 00		FROM	PAYROLL	
	MISCEL. LABOR		52 00		″	″ ″	
	SMALL TOOLS		12 00		″ E	REQUISITIONS	
	PACKING MATERIALS		62 00		″	REPORTS	
	BOXES		54 00		″ E	REQUISITIONS	
	FUEL		65 00		″	REPORTS	
	MISCEL. SUPPLIES		15 00		″ E	REQUISITIONS	
	MAINTENANCE MATERIALS		10 00		″ E	″	
	TOTAL DIRECT EXPENSE		395 00				
1	SHARE STEAM		11 81		″	DEP'T NO.	1
2	″ POWER & LIGHT		20 14		″	″ NO.	2
3A	″ T & M. LAB & EXP.		37 18		″	″ NO.	3
	″ FIXED CHARGES		14 00		″	FIXED CHARGE	SHEET
	TOTAL		478 13				
6	SHARE GENERAL FACTORY		224 25		″	DEP'T NO.	6
	TOTAL ANNEALING EXPENSE		702 38				
	DIRECT ANNEALING LABOR		600 00		″	PAYROLL	
	TOTAL LABOR & EXPENSE	1200 00	1302 38				
	TOTAL UNITS ANNEALED		3000 00		″	REPORTS	
	POSSIBLE UNITS		3500 00				
	PERCENT ACTIVITY		85.7				
	ANNEALING COST PER UNIT						
	LABOR	.002	.002				
	EXPENSE	.002	.002 34				
	TOTAL COST PER UNIT	.004	.004 34				
	ABNORMAL - LOSS	102 38					
	GAIN						

FORM 37-12.

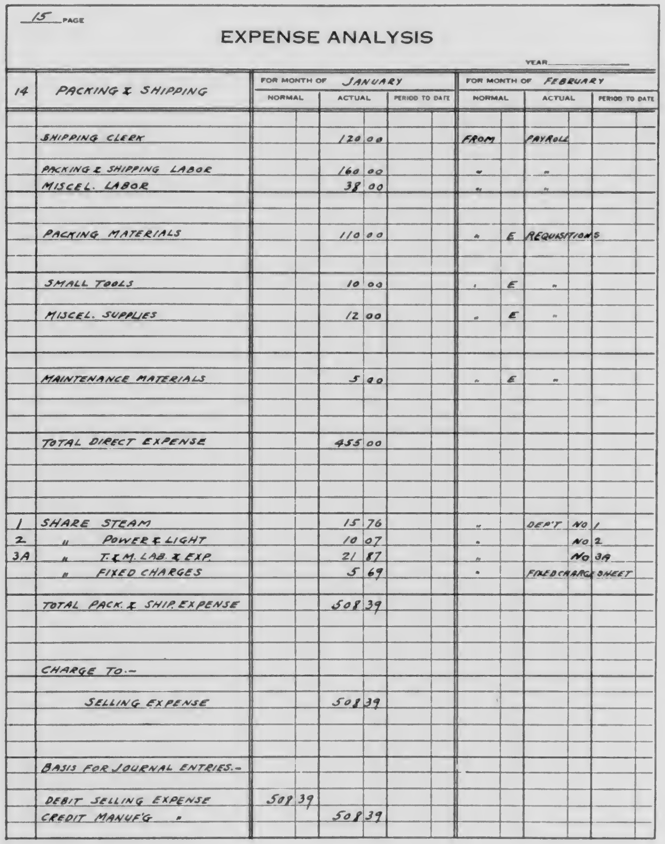
14 PAGE

EXPENSE ANALYSIS

YEAR________

13	MACHINE SHOP	FOR MONTH OF JANUARY			FOR MONTH OF FEBRUARY		
		NORMAL	ACTUAL	PERIOD TO DATE	NORMAL	ACTUAL	PERIOD TO DATE
	FOREMAN		150 00		FROM	PAYROLL	
	MISCEL. LABOR		125 00		″	″ ″	
	SMALL TOOLS		21 00		″ E	REQUISITIONS	
	OILS, GREASE, WASTE		18 00		″ E	″	
	GRINDING WHEELS		67 00		″ E	″	
	BELTING		118 00		″ E	″	
	MISCEL. SUPPLIES		47 00		″ E	″	
	MAINTENANCE MATERIALS		28 00		″ E	″	
	TOTAL DIRECT EXPENSE		574 00				
1	SHARE STEAM		55 16		″	DEP'T NO.	1
2	″ POWER & LIGHT		105 73		″	″ NO.	2
3A	″ T & M LAB. & EXP.		61 24		″	″ NO.	3
	″ FIXED CHARGES		20 00		″	FIXED CHARGE	SHEET
	TOTAL		816 13				
6	SHARE GENERAL FACTORY		585 75		″	DEP'T NO.	6
	TOTAL MACH. SHOP EXPENSE	1200 00	1401 88				
	DIRECT LABOR		2000 00		″	PAYROLL	
	PERCENT EXPENSE TO LABOR	60.	70.				
	ABNORMAL LOSS	201 88					
	GAIN						

FORM 37-13.



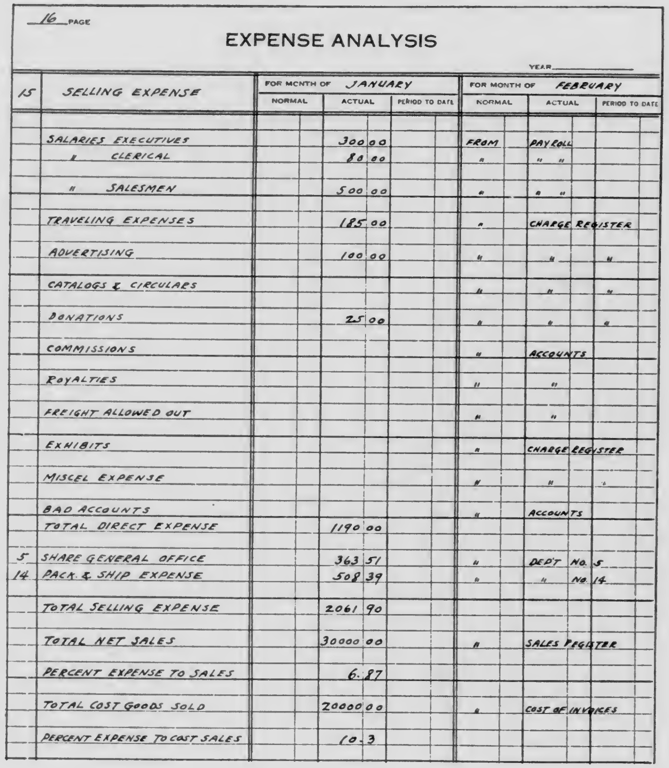
15 PAGE

EXPENSE ANALYSIS

YEAR ____

14	PACKING & SHIPPING	FOR MONTH OF JANUARY NORMAL	ACTUAL	PERIOD TO DATE	FOR MONTH OF FEBRUARY NORMAL	ACTUAL	PERIOD TO DATE
	SHIPPING CLERK		120 00		FROM	PAYROLL	
	PACKING & SHIPPING LABOR		160 00		"	"	
	MISCEL. LABOR		38 00		"	"	
	PACKING MATERIALS		110 00		" E	REQUISITIONS	
	SMALL TOOLS		10 00		" E	"	
	MISCEL. SUPPLIES		12 00		" E	"	
	MAINTENANCE MATERIALS		5 00		" E	"	
	TOTAL DIRECT EXPENSE		455 00				
1	SHARE STEAM		15 76		"	DEP'T NO 1	
2	" POWER & LIGHT		10 07		"	NO 2	
3A	" T. & M. LAB. & EXP.		21 87		"	NO 3A	
	" FIXED CHARGES		5 69		"	FIXED CHARGE SHEET	
	TOTAL PACK. & SHIP. EXPENSE		508 39				
	CHARGE TO.–						
	SELLING EXPENSE		508 39				
	BASIS FOR JOURNAL ENTRIES.–						
	DEBIT SELLING EXPENSE	508 39					
	CREDIT MANUF'G "		508 39				

FORM 37–14.



16 PAGE

EXPENSE ANALYSIS

YEAR ____

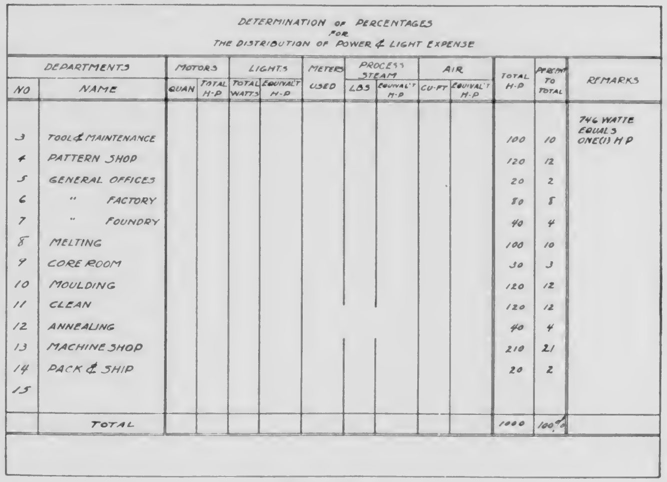
15	SELLING EXPENSE	FOR MONTH OF JANUARY NORMAL	ACTUAL	PERIOD TO DATE	FOR MONTH OF FEBRUARY NORMAL	ACTUAL	PERIOD TO DATE
	SALARIES EXECUTIVES		300 00		FROM	PAYROLL	
	" CLERICAL		80 00		"	" "	
	" SALESMEN		500 00		"	" "	
	TRAVELING EXPENSES		185 00		"	CHARGE REGISTER	
	ADVERTISING		100 00		"	"	"
	CATALOGS & CIRCULARS				"	"	"
	DONATIONS		25 00		"	"	"
	COMMISSIONS				"	ACCOUNTS	
	ROYALTIES				"	"	
	FREIGHT ALLOWED OUT				"	"	
	EXHIBITS				"	CHARGE REGISTER	
	MISCEL EXPENSE				"	"	"
	BAD ACCOUNTS				"	ACCOUNTS	
	TOTAL DIRECT EXPENSE		1190 00				
5	SHARE GENERAL OFFICE		363 51		"	DEP'T NO. 5	
14	PACK. & SHIP EXPENSE		508 39		"	" NO. 14	
	TOTAL SELLING EXPENSE		2061 90				
	TOTAL NET SALES		30000 00		"	SALES REGISTER	
	PERCENT EXPENSE TO SALES		6.87				
	TOTAL COST GOODS SOLD		20000 00		"	COST OF INVOICES	
	PERCENT EXPENSE TO COST SALES		10.3				

FORM 37–15.

The actual labor accounting will therefore be as follows:

(*a*)	Charged to Department No. 1	$ 4
(*b*)	Charged to Department No. 2	31
(*c*)	Non-chargeable labor (including foreman)	195
(*d*)	Chargeable labor	300
	Total Department Labor	$530

Item (*c*) is considered a part of the department expense while item (*d*), the chargeable labor, becomes the direct labor which is used as a basis for distributing the departmental expense.



DETERMINATION OF PERCENTAGES
FOR
THE DISTRIBUTION OF POWER & LIGHT EXPENSE

DEPARTMENTS		MOTORS		LIGHTS		METERS	PROCESS STEAM		AIR		TOTAL H-P	PERCENT TO TOTAL	REMARKS
NO	NAME	QUAN	TOTAL H-P	TOTAL WATTS	EQUIVAL'T H-P	USED	LBS	EQUIVAL'T H-P	CU-FT	EQUIVAL'T H-P			
3	TOOL & MAINTENANCE										100	10	746 WATTE EQUALS ONE(1) H P
4	PATTERN SHOP										120	12	
5	GENERAL OFFICES										20	2	
6	" FACTORY										80	8	
7	" FOUNDRY										40	4	
8	MELTING										100	10	
9	CORE ROOM										30	3	
10	MOULDING										120	12	
11	CLEAN										120	12	
12	ANNEALING										40	4	
13	MACHINE SHOP										210	21	
14	PACK & SHIP										20	2	
15													
	TOTAL										1000	100%	

Form 38.

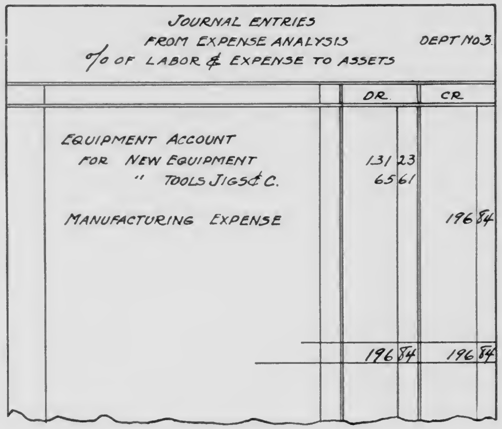
The total expense as shown in the analysis is	$356.14
Chargeable labor	300.00
Expense to labor, per cent	118.7

Forwarding these items to page 4 of the analysis Form 37–3*a*, we find another item "Total Labor and Expense" amounting to $656.14.

The amount of the labor chargeable to the other departments is determined from an analysis of the time cards as shown on page 4 of the expense analysis, Form 37–3*a*,

Just below the list of departments on this sheet are charges to new equipment which covers the labor used on work chargeable to the asset accounts. Such charges do not belong in the expense of doing business because this labor and material has increased the value of equipment needed for production and becomes a part of the investment.

60. Charging the Proper Accounts.—With the items of chargeable labor posted against the department the proportion of Tool and Maintenance Expense is determined and the sums checked with the total chargeable labor and expense of the department, $656.14. These totals are then distributed by posting to the expense analysis of the succeeding departments opposite the item "tool and maintenance labor and expense." The amounts to be charged to asset accounts "new equipment" and "tools, jigs and fixtures" are then journalized as credits to manufacturing expense and debits to the asset accounts. These entries are shown on Form 39, and the ledger accounts are affected as shown on Form 40.



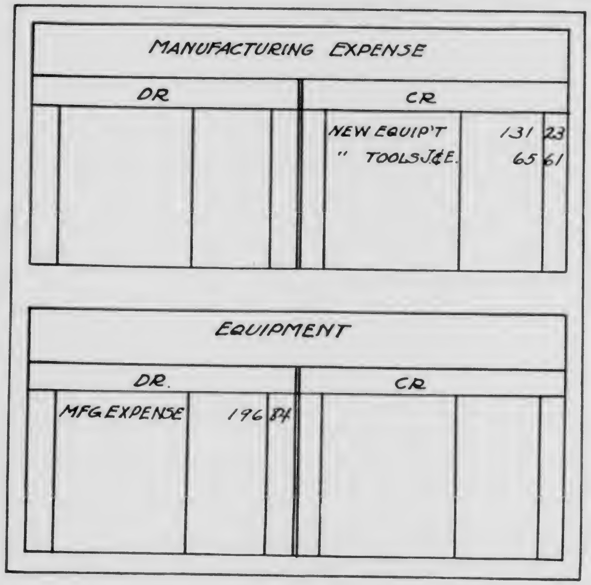
JOURNAL ENTRIES
FROM EXPENSE ANALYSIS
% OF LABOR & EXPENSE TO ASSETS
DEPT NO 3.

	DR.	CR.
EQUIPMENT ACCOUNT		
FOR NEW EQUIPMENT	131 23	
" TOOLS JIGS &C.	65 61	
MANUFACTURING EXPENSE		196 84
	196 84	196 84

Form 39.

The material which has been used in the various departments for maintenance has been charged direct from the expense requisitions, and is shown opposite the item "Maintenance Materials." Materials for new equipment may be charged direct to assets from the charge register, or from the expense requisitions if drawn from stores.

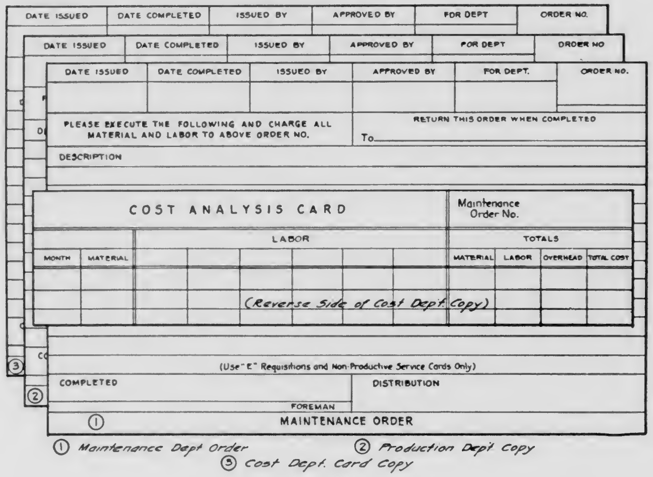
Minor repairs taking only a few minutes do not require, as a rule, an order authorizing them. The routine would not be worth while, and they can be satisfactorily accounted for by the time cards and expense requisitions. The larger jobs, however, should be requested through the production department on a "maintenance order," so that their cost may be known and followed up.



FORM 40.

Again there may be requirements for additions to buildings, setting up purchased equipment, building new equipment, making new flasks or new sets of patterns, and so on. No one of such jobs should be undertaken without first issuing a properly authorized order. One form of

order is sufficient to cover all this class of work. If one of these jobs should require five months to complete, the monthly cost is carried to the asset accounts through the analysis of material used and the Tool and Maintenance analysis sheet. The complete cost of the job is collected and shown on the "Cost Analysis Card," Form 41. It may then be posted to the plant equipment ledger.



FORM 41.

CHAPTER VIII

THE CONTRIBUTORY DEPARTMENTS' EXPENSE

The expense of the Pattern Shop, which is considered a contributory department, is distributed in much the same way as that of the tool and maintenance department, but here the material used has been listed instead of charged direct to the general ledger accounts.

61. The Pattern Shop Expense.—Either method will serve reasonably well for both departments. It is advisable, however, to adopt but one method for the sake of uniformity.

To distribute the labor, it must be analyzed from the time cards, as follows:

New Patterns	$150
New Buildings	75
Moulding Expense:	
Patterns	42
Flasks	33
Direct Orders	100
	$400

To these items are added—as shown on the distribution part of the expense analysis—the proportion of the department's expense and the material.

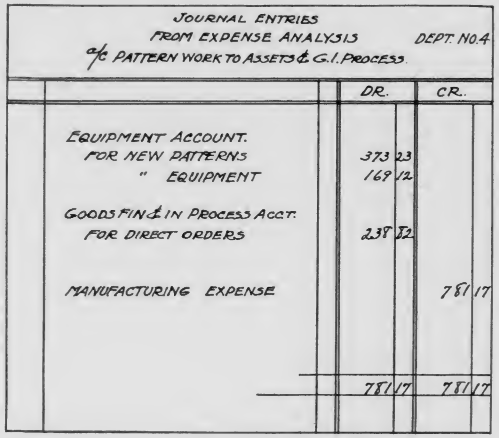
The items "new patterns" and "new equipment" are charged to the asset account and credited to the Manufacturing Expense Account, just as is the new equipment expense in the Tool and Maintenance Department.

Moulding expense covers the cost of repairs and upkeep of working patterns, core boxes and flasks, and so is chargeable to the Moulding Department.

If the foundry receives orders to make the patterns as well as the castings, the cost of the pattern may be chargeable to the customer when shipment is made. The cost thus collected from direct orders is credited to Manufacturing Expense and debited to the Goods in Process Account, because this cost must be figured into the cost of goods sold.

The journal entries resulting from the Pattern Shop analysis are shown on Form 42, and the ledger accounts as affected by these entries are shown on Form 43.

Costs of the Pattern Shop are collected in the same way and on the same form—Form 41—as are those of the Tool and Maintenance Department.



JOURNAL ENTRIES
FROM EXPENSE ANALYSIS DEPT. NO. 4
a/c PATTERN WORK TO ASSETS & G. I. PROCESS.

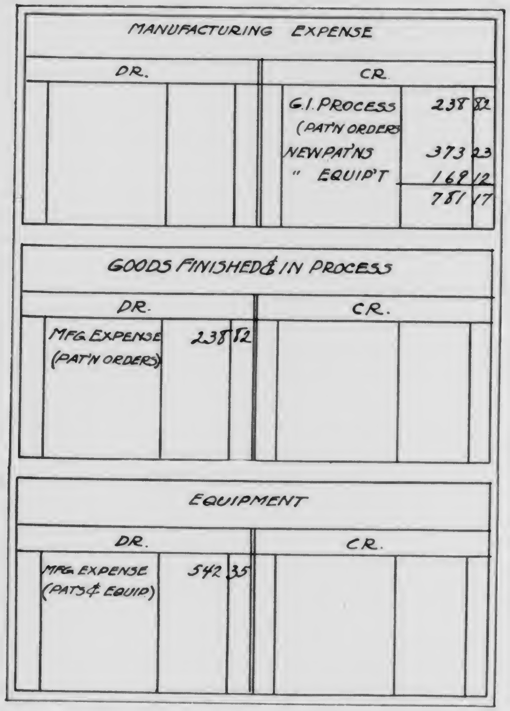
	DR.		CR.	
EQUIPMENT ACCOUNT.				
FOR NEW PATTERNS	373	23		
" EQUIPMENT	169	12		
GOODS FIN & IN PROCESS ACCT.				
FOR DIRECT ORDERS	238	82		
MANUFACTURING EXPENSE			781	17
	781	17	781	17

Form 42.

62. The General Office Expense.—The expense of the General Office Department includes the salaries of officers, clerks, etc., together with such items as are usual with administration and general office management.

The officers' and other executive salaries are subject to some variation, depending somewhat upon the size of the organization and the nature of the executives' duties. The general manager—who may really be the president and who has various combinations of responsibilities in different foundries, gives, as a rule, part of his time to manufacturing and part to the selling policies.

In the same way it may be that all of the items of general office expense are utilized for both selling and manufacturing. If so, some way must be found to allocate the expense equitably between the two activities. Whenever possible, office expenses should be charged direct to whichever side of the business is benefitted by them, but in small foundries, where a single person divides his time, it is necessary to prorate the expense based upon a study of just how the time and effort is put in.



MANUFACTURING EXPENSE

DR.			CR.		
			G.I. PROCESS (PAT'N ORDERS	238	82
			NEW PAT'NS	373	23
			" EQUIP'T	169	12
				781	17

GOODS FINISHED & IN PROCESS

DR.			CR.		
MFG. EXPENSE (PAT'N ORDERS)	238	82			

EQUIPMENT

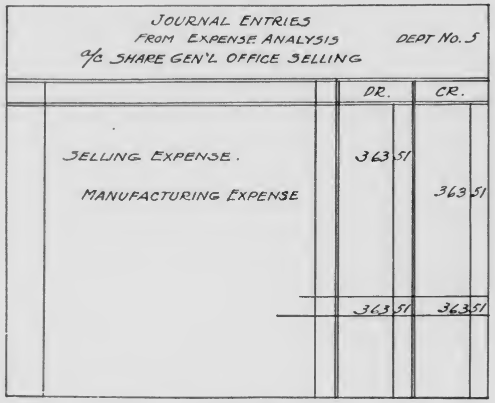
DR.			CR.		
MFG. EXPENSE (PATS & EQUIP)	542	35			

Form 43.

The closeness with which this division can be determined is well within the reach of practical accuracy and economy.

In addition to the salaries and miscellaneous expense items, there is the share of Steam, Power and Light, Tool and Maintenance labor and expense, which have been distributed from these departments, and the share of fixed charges. The charge for Tool and Maintenance expense to the General Offices covers such items as repairs and alterations to the office and its fixtures.

In this case let us assume that a study shows that 75 per cent of the activities of the General Office are for the benefit of manufacturing and 25 per cent for selling. Then the $1,454.03 total expense is divided.



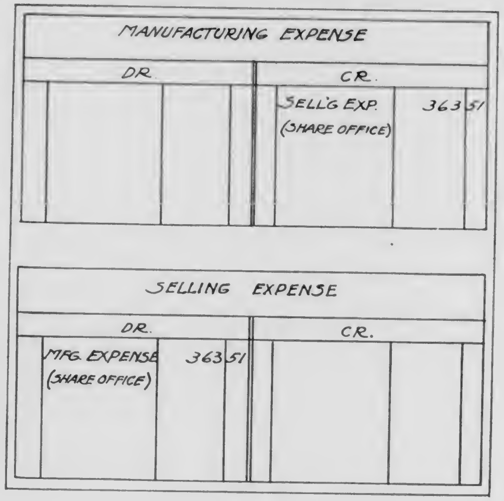
JOURNAL ENTRIES
FROM EXPENSE ANALYSIS DEPT No. 5
a/c SHARE GEN'L OFFICE SELLING

	DR.		CR.	
SELLING EXPENSE.	363	51		
MANUFACTURING EXPENSE			363	51
	363	51	363	51

Form 44.

	Per Cent	Amount
Selling Expense	25	$ 363.51
General Factory	75	1,090.52
		$1,454.03

As a result, the $363.51 is credited to Manufacturing Expense, and debited to Selling Expense. This amount is then posted to the expense analysis of the selling department, Form 37–15 and the balance, $1,090.52 is posted to the expense analysis of the General Factory Department, Form 37–6. The journal entries and the acoucnts as they are affected are illustrated respectively by Forms 44 and 45.



MANUFACTURING EXPENSE

DR.		CR.	
		SELL'G EXP. (SHARE OFFICE)	363 51

SELLING EXPENSE

DR.		CR.	
MFG. EXPENSE (SHARE OFFICE)	363 51		

FORM 45.

63. The General Factory Department.—The expense of the General Factory Department includes these items which apply to the factory as a whole, and which cannot be charged directly to any other department.

General supervision, with its clerical assistance, as well as general store room help, watchmen and janitors, yard labor and miscellaneous help is obviously an expense which benefits all other departments. Some executives feel that the purchasing department should be treated as a part of the General Office. But this department's principal effort is to buy equipment, materials and supplies for manufacturing, and consequently we believe that its expense is rightly a part of the General Factory Department, which serves manufacturing generally. The time which the purchasing agent puts in buying supplies and fixtures for the general offices is so exceedingly small that the error involved is inconsequential.

Since the truckmen and trucking expense serve both shipping and manufacturing, there is a difference of opinion as to how the charge should be handled. The trucking expense involves the cost of trucking from the Packing Department to the freight terminals, from receiving points to the general stores for raw materials, supplies, equipment and returned goods, and the general trucking for miscellaneous plant service. To attempt to divide this expense on the basis of the actual activity would require excessive clerical detail, and, since its accuracy depends upon the accuracy of the reports turned in by more or less illiterate truckman, it is doubtful if the extra effort is worth while. Therefore, we believe greater simplicity and at least equal accuracy is obtained by charging the expense to General Factory and making the distribution proportionately to production. Where the organization is large and the trucking can be definitely analyzed, to divide the expense becomes a simple matter. Here again the conditions in the individual foundry must govern.

In this particular instance, the entire trucking expense has been included in the General Factory Department.

64. The Expense Items.—In addition to the usual list of miscellaneous supplies, there are the new items of water, rent, demurrage, miscellaneous freight and express, freight on returned goods, etc. Water is used for general plant service and in most instances passes through a single city meter. In larger plants, there may be a separate meter for boiler use, in which case the charge for its water is made direct to the Steam Department. Otherwise, the entire expense for water had best be charged to the General Factory Department.

Freight and express charges should go into the cost of materials and supplies, but in every factory there are a number of these charges which are difficult to charge direct and can best be handled by charging them to the General Factory Department.

65. Returned Goods Accounting.—Since goods returned must be debited to Sales and credited to the Cost of Goods Sold, so as to get them back into the Goods in Process Inventory at cost, the freight or express charges involved become items of expense of the General Factory Department. If, however, the goods are returned because defective and they must be scrapped, there is an element of expense involved which must be carried into the cost.

If the original sales price was		$ 500
and the cost of sales was		400
with the cost composed of:		
Metal	$ 150	
Labor	150	
Expense	100	
		$ 400
and the scrap value		75

The accounting would be as follows:

		Dr.	Cr.
Sales		$ 500	
Accounts Receivable			500
Goods Finished and in Process		400	
Cost of Goods Sold			400
Pig and Scrap Account		75	
Manufacturing Expense:			
Loss on Defective Returns:			
Metal	75		
Labor	150		
Expense	100		
		325	
Goods Finished and in Process			400
		$1,300	$1,300

The entire loss involved in the transaction is a business expense and must be included in the cost of manufacturing. The loss in this instance amounts to $325.

66. Shop Scrap.—In the case of shop scrap returned to the foundry a similar accounting is necessary. Five hundred dollars worth of castings, at cost, may be broken and

returned for remelting. This amount accordingly becomes a credit to the Goods Finished and in Process Account, assuming of course that $500 is the value of the castings, at cost, at the point in the process of manufacturing where the breakage occurred. Scrap value becomes the only salvage, and the difference, which becomes a loss, must be included in the cost, charging it to Manufacturing Expense. Hence the item in the analysis, "Loss on Defective Shop and Returned Castings."

Following the above expenses, the analysis sheet shows the

Share of Steam
Share of Power and Light
Share of T. & M. Labor and Expense
General Office
Share of Fixed Charges

all of which go to make up the total expense of the department which amounts to $2,639.96.

67. Distributing General Factory Expense.—How to distribute the General Factory Expense to the productive departments is important. Several methods are possible, all of which may be in use in one foundry or another.

Let us see what the effect on the unit costs would be, under each of the common methods of distributing the expense of this important General Factory Department.

The three methods are:

1. On the basis of the productive labor dollar.
2. On the basis of the total department payroll.
3. On the basis of the total department labor and expense.

The productive labor dollar is probably in most general use because of its simplicity, and is based on the principle that the General Factory Expenses are incurred for the benefit of and hence in proportion to the amount of direct labor used in each department.

Under this method the total of the direct labor in each department is listed for the month. The amount of this expense is divided by the total direct labor to give the percentage of the General Factory Expense to the total direct labor. This percentage is then applied to the direct labor of each department to obtain the amount of the general factory expense chargeable to each department.

68. An Example.—To illustrate, we may use the direct labor from the productive departments which are shown in the analysis for one typical foundry.

General Factory Expense........................ $2,639.96

Department	Direct Labor	Share, Gen. Factory
Dept. 8	$ 350.00	$ 122.38
Dept. 9	700.00	244.76
Dept. 10	3,200.00	1,118.93
Dept. 11	700.00	244.76
Dept. 12	600.00	209.80
Dept. 13	2,000.00	699.33
Total	$7,550.00	$2,639.96

Dividing $2,639.96 by $7,550 gives 34.97 per cent is the percentage to be applied against the direct labor of each department to determine its share of General Factory Expense.

If there is a wide variation in the character of the work, or a marked difference in the rates of pay of different departments, this method may result in charging too much of the expense to one department and not enough to another. Again, if a department increases the rate of pay without increasing the number of employes or its production, while the payrolls of the other departments remain fairly constant, this department will improperly absorb a greater amount of the General Factory Expense, thus raising the unit cost in the department.

In applying this method, attention should be given to the balance of conditions with reference to production, equipment and methods of pay, if accurate results are to be secured.

69. The Basis of Distribution.—The total department payroll basis is more representative of the total number of employes and their combined earnings, but it contains to a considerable extent the same element of error as the first. The same caution should be exercised in applying it. The results will be somewhat different from the result of the first method.

It does not take into consideration other operating conditions over which the General Factory Department has supervision, yet is an improvement over the first method when conditions of work and rates of pay vary.

The method of calculation is the same as with the first method except that the total payroll of the department is used instead of the direct labor only.

The total labor and expense basis takes into consideration that the General Factory Expense is entailed by the general supervision which this department exerts over all operating expense and labor. It is therefore reasonable to consider that the expense of supervision is closely proportioned to the total labor and expense of the departments. A greater degree of accuracy in distribution is possible with this method.

The calculations for this method are the same as discussed for the first two, except that the total labor and expense is collected instead of the direct labor or the total payroll.

The element of error which was mentioned in applying the preceding methods still exists in the application of this method, but with the total operating expenses included, a much better balance of conditions is secured and the effect of this error is greatly reduced.

70. Another Method.—This method is used to distribute the General Factory Expense in the analysis, Form 37–6.

There is, however, still a fourth method which has its advantages in certain foundries. It is often quite accurate and should be described, although we do not use it in distributing the expense of the General Factory Department of the typical foundry we are describing in this book.

The productive labor hour is the basis of the method, the principle underlying which is the same as of the direct labor dollar method except that the labor is measured in time instead of dollars. This means that the General Factory Expense is considered to be in proportion to the number of hours put in, in each department, by the direct labor operators rather than to their earnings.

This method requires the additional work of collecting the hours per producer, but this factor is not an excessive clerical job and may be well worth the additional effort.

To substitute this method for the one illustrated, the only change needed is to add an item in each productive department, showing the "productive man hours." It would mean no additional work in the expense analysis.

The third method, which has been used in the illustrated analysis, serves excellently all practical purposes and is a shade easier to operate.

71. A Practical Plan.—To distribute the General Factory Expense on the basis of the total labor and expense of the various departments, it is necessary to turn to the other department's expense analysis for the data. For instance, on the expense analysis of the General Foundry Department, Form 37–7, the item marked "Total, $1,205.27, represents the total of the direct and indirect expense so far accounted for. There being no productive labor in this department, the $1,205.27 is posted to the expense analysis of the General Factory Department, Form 37–6. The total of the Melting Department amounts to $568.26. To this is added the direct labor of $350, giving a total of labor and expense of $918.26. This amount is likewise posted to the General Factory Department expense analysis.

This process is carried out for all of the succeeding departments and the calculations made for the distribution of the expense.

The calculation is as follows: (See Form 37–6).

Dept. No.	Name	Labor and Expense	Share, Gen. Factory
7	General Foundry.............	$ 1,205.27	$ 251.32
8	Melting.....................	918.26	191.07
9	Core Room...................	1,302.49	270.91
10	Moulding....................	4,219.18	876.70
11	Cleaning....................	1,153.67	239.96
12	Annealing...................	1,078.13	224.25
13	Machine Shop................	2,816.13	585.75
		$12,693.13	$2,639.96

This table shows that the total of the labor and expense for all the departments amounts to $12,693.13, and the expense analysis, Form 37–6, shows the General Factory Expense to be $2,639.96. We then determine the ratio of these items as follows:

$$\frac{2,639.96}{12,693.13} = 20.8 \text{ per cent}$$

This percentage is then applied against the department amounts in order to determine the share of General Factory to be charged, *i.e.* for the

Core Room........ 20.8 per cent of $1,302.49 = $270.71
Cleaning.......... 20.8 per cent of 1,153.67 = 239.96, etc.

If the sum of these shares checks with the total of the General Factory Expense, they are posted to the expense analysis of their departments and the General Factory Department closed.

72. There is No One Best Way.—No one of the three methods of distributing the General Factory Expense is preferable for all foundries. For any foundry, there is one best method which it is the duty of the cost engineer to decide. Bear in mind in making such distribution that absolute accuracy in manufacturing costs is not a possibility; but practical accuracy is attainable. The effort must be to get the highest degree of refinement which conditions permit, and experience dictates, in the development of costs in order to avoid, to as great an extent as possible, inconsistencies and errors which the wrong method will surely produce.

73. Different Results from Different Methods.—To show how different methods give different results, we have shown on Form 46 how the unit costs are affected by each of the three methods of distributing the General Factory Expense.

METHODS & DEPARTMENTAL RESULTS
DISTRIBUTION OF GEN'L FACTORY EXPENSE

DEPARTMENT		PRODUCTIVE LABOR DOLLAR			TOTAL PAY ROLL			DEPT LABOR & EXPENSE		
NO	NAME	PROD LABOR	SHARE GEN'L FAC	DEPT % OR UNIT COST	PAY ROLL	SHARE GEN'L FAC	DEPT % OR UNIT COST	DEPT LAB & EXP	SHARE GEN'L FAC	DEPT % OR UNIT COST
7	GENERAL FOUNDRY				1020.00	276.82		1205.27	251.32	
8	MELTING	350.00	122.38	02008	430.00	116.70	02015	918.26	191.07	.0206
9	CORE ROOM	700.00	244.76	145%	860.00	233.41	152%	1302.49	270.91	161%
10	MOULDING	3200.00	1118.93	91%	3490.00	947.23	90%	4219.18	876.70	84 6%
11	CLEANING	700.00	244.76	0056	875.00	237.44	.00578	1155.67	239.96	0058
12	ANNEALING	600.00	209.80	.00429	777.00	210.88	.0043	1078.13	224.25	.00434
13	MACHINE SHOP	2000.00	699.33	75 8%	2275.00	617.48	71 7%	2816.13	585.75	70%
	TOTAL	7550.00	2639.96		9727.00	2639.96		12693.13	2639.96	
	GENERAL FACTORY % FOR DISTRIBUTION			34.97			27.1			20 8%

FORM 46.

The difference in the resulting unit costs for the departments is due to the varying amounts of the General Factory Expense with which the departments are charged under the various methods.

The figures in the table show practically no variation in the melting base cost. The cents per pound is the round figure in each case. The Core Department shows an increase in the percentage of expense because of the greater amount of indirect labor in the second instance and the amount of expense material in the third. With this increase due to the expense materials, the Core Department is charged with a greater proportion of the expense because more supervision is required. The Moulding Department shows a slight increase in expense to labor because the ratio of expense materials is so much less than in the Core Department. The Cleaning and Annealing Departments show about the same results with a little decrease in the ratio for the machine shop.

Since the General Factory Expense is one of the largest of all items to be distributed, it is well worthy of the closest study.

74. The General Foundry Department.—We have now to consider the last of the contributory departments—the General Foundry Department.

In the foundry proper there is the Melting, Core Room, Moulding, and Cleaning Departments, each of which may have its foreman, miscellaneous labor, etc., which are direct charges to their respective departments. There are also the general foundry superintendent, general foreman, pattern storage help, flask and equipment help, chemist and general labor for the whole foundry and a few expense items as well as the shares of Steam, Power and Light, Tool and Maintenance, labor and expense, and fixed charges, all of which go to make up the General Foundry Expense. This means that none of these items are chargeable direct to any one of the productive departments but must be collected and distributed in exactly the same way and on the same basis as the General Factory Department expense.

The expense analysis of this department is soon on Form 37–7 to be $1,456.59. The collection of the total labor and expense from the Melting, Core, Moulding, and Cleaning Departments gives a total of $7,594.87. The ratio of General Foundry Expense to the departmental labor and expense totals is 19.2 per cent. With the use of this percentage, the amounts to be distributed are determined and then posted to the productive departments of the foundry. This transaction closes the General Foundry Expense and it has become absorbed, so to speak, by the productive departments.

75. The Laboratory Expense.—It may be well to point out here that the way of handling the expense of the chemists and the laboratory will depend upon the individual foundry. If the chemist is employed and the laboratory maintained strictly for foundry use, the charge should be made to the General Foundry Department as shown, but if the laboratory serves other departments of the plant, the expense should be placed where it will be given a more general distribution, preferably in the General Factory Department. If an outside laboratory is employed, the amount will invariably be charged to the General Foundry, except when an analysis may be needed for some other department, in which case it would be charged to that department.

76. The Expense Analysis.—The expense analysis of the General Foundry Department provides control over the foundry supervision, with its associated expenses, by way of comparison and its ratio to the total operating expenses of the productive departments. The ratio shown is 19.2 per cent. An increase in this percentage suggests an investigation for the purpose of bringing about the needed economies.

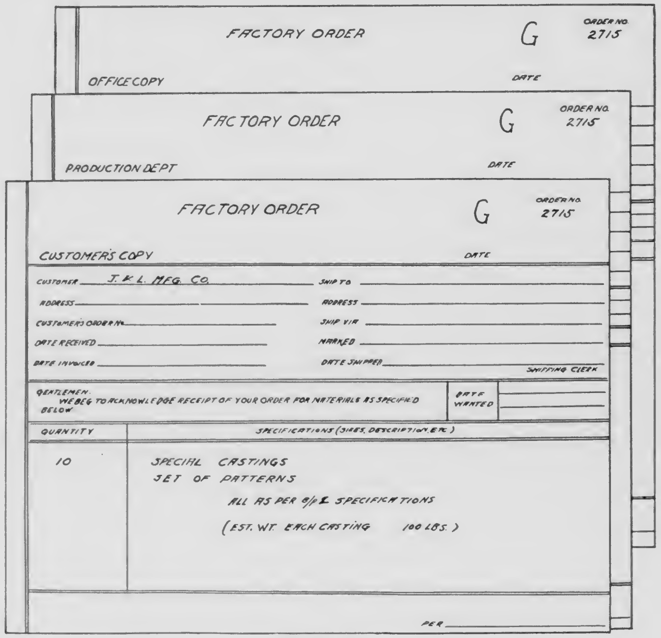
If increased efficiency in the management of the department is striven for, a decrease in this percentage will tell to what extent the effort has been effective as measured in dollars and cents.

It is the use of costs in this manner which makes manufacturing costs of most value. The analysis must be studied constantly, for therein lies the means of controlling the conditions of your foundry and consequently a basis for more satisfactory returns.

CHAPTER IX

FIGURING THE METAL COST

In the two preceding chapters the expense of all contributory or non-productive departments has been gathered and then charged to the various productive departments in the proportion each should bear. We are now ready to gather all of the expense of the productive departments and apply that expense justly to the castings produced.



FACTORY ORDER G ORDER NO. 2715
OFFICE COPY DATE

FACTORY ORDER G ORDER NO. 2715
PRODUCTION DEPT DATE

FACTORY ORDER G ORDER NO. 2715
CUSTOMER'S COPY DATE

CUSTOMER J. & L. MFG. CO.
ADDRESS
CUSTOMER'S ORDER No.
DATE RECEIVED
DATE INVOICED
SHIP TO
ADDRESS
SHIP VIA
MARKED
DATE SHIPPED
SHIPPING CLERK

GENTLEMEN.
WE BEG TO ACKNOWLEDGE RECEIPT OF YOUR ORDER FOR MATERIALS AS SPECIFIED BELOW
DATE WANTED

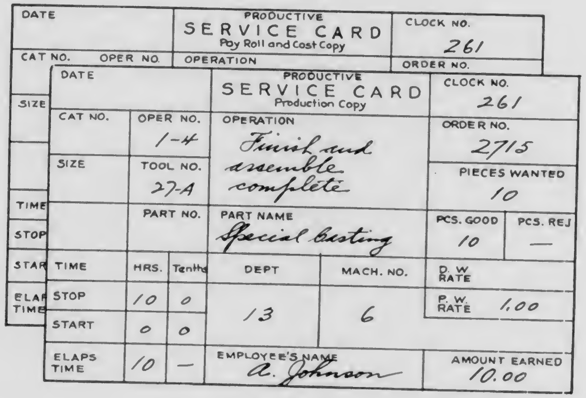
QUANTITY	SPECIFICATIONS (SIZES, DESCRIPTION, ETC.)
10	SPECIAL CASTINGS SET OF PATTERNS ALL AS PER B/P SPECIFICATIONS (EST. WT. EACH CASTING 100 LBS.)

PER

Form 47.

A factory order for the castings in question is illustrated as Form 47. This particular form of order is obviously not essential. It serves to illustrate only.

The material, labor and expense cost of these castings must be collected as they pass through the various departments. A form which serves well for this purpose is illustrated as Form 49.



DATE
PRODUCTIVE SERVICE CARD Pay Roll and Cost Copy
CLOCK NO. 261
CAT NO. OPER NO. OPERATION ORDER NO.
SIZE
TIME
STOP
STAR
ELAP TIME

DATE	PRODUCTIVE SERVICE CARD Production Copy		CLOCK NO. 261
CAT NO.	OPER NO. 1-4	OPERATION Finish and assemble complete	ORDER NO. 2715
SIZE	TOOL NO. 27-A		PIECES WANTED 10
	PART NO.	PART NAME Special Casting	PCS. GOOD 10 / PCS. REJ —

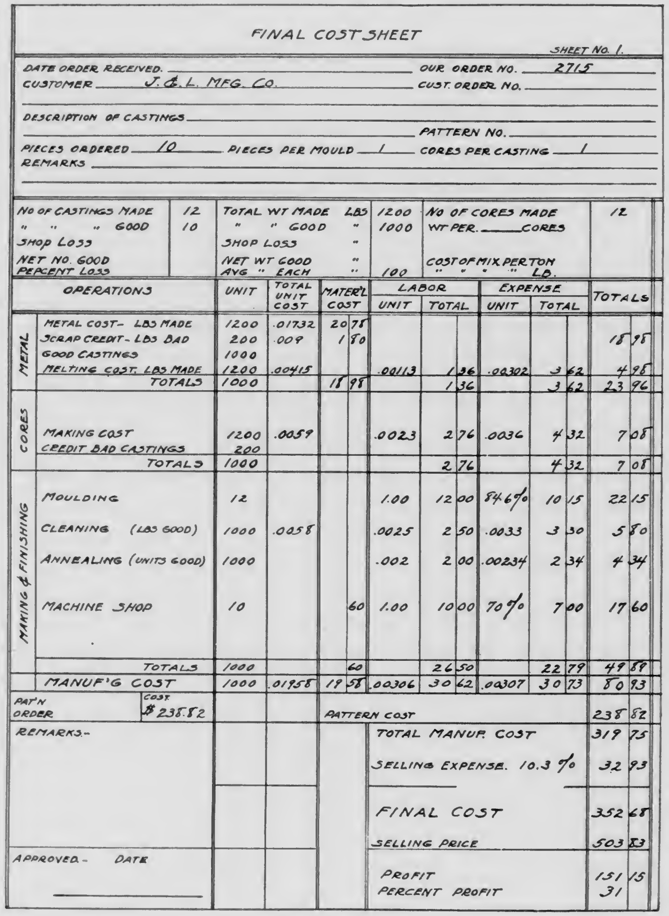
TIME	HRS.	Tenths	DEPT	MACH. NO.	
STOP	10	0	13	6	D. W. RATE
START	0	0			P. W. RATE 1.00
ELAPS TIME	10	—	EMPLOYEE'S NAME a. Johnson		AMOUNT EARNED 10.00

Form 48.

To keep the description of the method as simple as possible, the current month's cost figures are used. The final application for normal costs will be treated in another chapter.

77. The Melting Department.—Melting is the first of the productive departments. The method of costing is the same whether the furnace be a cupola, crucible, air-furnace, open-hearth, or electric, but the items entering the expense would differ owing to the difference in the kind of fuel, maintenance and supplies necessary.

The items of expense shown in the analysis, Form 37–8, are typical, and largely self-explanatory. Note that this, the first of the productive departments, carries its share of the six contributory departments.



FINAL COST SHEET
SHEET No. 1.

DATE ORDER RECEIVED. ______ OUR ORDER NO. 2715
CUSTOMER J. & L. MFG. CO. ______ CUST. ORDER NO. ______
DESCRIPTION OF CASTINGS ______
PATTERN NO. ______
PIECES ORDERED 10 PIECES PER MOULD 1 CORES PER CASTING 1
REMARKS ______

NO OF CASTINGS MADE	12	TOTAL WT MADE LBS	1200	NO OF CORES MADE	12
" " " GOOD	10	" " GOOD "	1000	WT PER. ____ CORES	
SHOP LOSS		SHOP LOSS "			
NET NO. GOOD		NET WT GOOD "		COST OF MIX PER TON	
PERCENT LOSS		AVG " EACH "	100	" " " " LB.	

	OPERATIONS	UNIT	TOTAL UNIT COST	MATER'L COST	LABOR UNIT	LABOR TOTAL	EXPENSE UNIT	EXPENSE TOTAL	TOTALS
METAL	METAL COST - LBS MADE	1200	.01732	20 78					
	SCRAP CREDIT - LBS BAD	200	.009	1 80					18 98
	GOOD CASTINGS	1000							
	MELTING COST. LBS MADE	1200	.00415		.00113	1 36	.00302	3 62	4 98
	TOTALS	1000		18 98		1 36		3 62	23 96
CORES	MAKING COST	1200	.0059		.0023	2 76	.0036	4 32	7 08
	CREDIT BAD CASTINGS	200							
	TOTALS	1000				2 76		4 32	7 08
MAKING & FINISHING	MOULDING	12			1.00	12 00	84.6%	10 15	22 15
	CLEANING (LBS GOOD)	1000	.0058		.0025	2 50	.0033	3 30	5 80
	ANNEALING (UNITS GOOD)	1000			.002	2 00	.00234	2 34	4 34
	MACHINE SHOP	10		60	1.00	10 00	70%	7 00	17 60
	TOTALS	1000		60		26 50		22 79	49 89
	MANUF'G COST	1000	.01958	19 58	.00306	30 62	.00307	30 73	80 93
PAT'N ORDER	COST $238.82			PATTERN COST					238 82
REMARKS.-					TOTAL MANUF. COST				319 75
					SELLING EXPENSE. 10.3 %				32 93
					FINAL COST				352 68
					SELLING PRICE				503 83
APPROVED.- DATE					PROFIT				151 15
					PERCENT PROFIT				31

Form 49.

The melting expense for this foundry includes the cost of handling the materials and delivering them to the cupola. In a very large plant, the unloading and yard would be a separate department.

While in this foundry the unloading and handling labor is treated as a part of the expense, it is advisable, where possible, to charge such labor direct to the material unloaded. This will give a handling cost per ton or unit which must be taken into account when figuring the cost of metal or material.

78. Two Parts to This Department.—It is advisable to divide the melting cost into two parts; therefore we develop on Form 37–8 the melting cost proper, and on Form 37–8*a* the metal cost. The total expense of the melting is found to be $935.51, to which is added the direct melting labor. This gives a total of $1,285.51 for melting labor and expense. The next items are "Pounds of Metal Melted" and "Cost per Pound to Melt" which are strictly statistical and are not to be used as cost figures. They are provided as a guide to the efficiency of the operation from month to month.

The next item "Total Pounds of all Castings Produced" includes all castings, good and bad. This item in connection with the labor and expense gives a base cost per pound of $0.00415, as developed in the calculation on Form 37–8.

79. Using a Base Cost.—Why is this "base" cost used? Of the total metal charged into the cupola only part of it is found in the castings, consequently in order to arrive at the melting cost of good castings, there must be deducted the scrap returned to the cupola, constituted of scrap castings, sprues, gates and over-iron; but not the scrap castings returned from the other departments, such as the machine shop, mounting shop, etc. The net weight of these good castings, 280,000 lb. is obtained from the foundry report summary, Form 20.

If this weight were used to determine the melting cost, the cost per pound to melt would be $\frac{1,285.51}{280,000} = \$0.00459$.

In foundries whose product is uniform and whose percentage of loss is fairly constant, this method will give satisfactory results; but in foundries with a variety of work and correspondingly varying percentages of loss, it will not give correct costs.

What would happen were this melting cost per pound of $0.00459 for all good castings used in a foundry which makes a wide variety of castings with losses ranging from 5 to 15 per cent?

80. When the Losses Vary.—It is obvious that the labor and expense cost to melt the metal for the castings having a loss of 15 per cent will be greater than for the castings with only a 5 per cent loss. The actual difference in the melting cost can be determined only by using the cost, which, remember, is the melting cost per pound of all castings, both good and bad.

Using this figure the cost per pound for castings having 5 per cent loss will be:

Weight all castings produced	525 pounds
Weight good castings produced	500 pounds
Weight bad castings produced	25 pounds
Melting cost per pound all castings	$0.00415
Cost to melt 525 pounds	$0.00415 × 525 = $2.17875
Weight bad castings	25
Melting cost for good castings	500 = $2.17875
Cost per pound for good castings	$0.0043575

For those castings having 15 per cent less the cost per pound will be:

Weight all castings produced	575 pounds
Weight good castings produced	500 pounds
Weight bad castings produced	75 pounds
Melting cost per pound, all castings	$0.00415
Cost to melt 575 pounds	$0.00415 × 575 = $2.38625
Weight bad castings	75
Melting cost for good castings	500 = $2.38625
Cost per pound	$0.0047725

The 15 per cent class thus shows a melting cost per pound for good castings which is $0.000415 higher than the 5 per cent class. The weights used in these calculations are small and the difference may therefore seem insignificant; but for a large production the error would quickly amount to thousands of dollars.

81. A Common Error.—Note that the percentage of loss is taken as the ratio of bad castings to good castings; not the ratio of bad to total. When estimating on an order it is necessary to determine the expected loss and add that percentage to the weight of good castings wanted. Thus for an order of 10,000 pounds of castings in which 5 per cent bad are expected, it must be expected that 10,500 pounds of good and bad castings must be made. More than 10,500 pounds of metal will have to be melted to allow for gates, sprues, over-iron and melting loss, but it is to be noted that the unit cost is determined on the basis only of good and bad castings produced. The reason for using this basis to determine the unit cost of melting will be obvious with the following illustrations.

The analysis figures are used to illustrate this point.

	Pounds	Cost
Melting cost	400,000	$1,285.51
Melting loss	20,000	
Metal accounted for	380,000	
Gates, sprues, etc	70,000	
Net good and bad castings	310,000	
Melting cost		$1,285.51
Cost per pound to melt		.00415

While the labor and expense cost to melt 400,000 pounds is $1,285.51, the return of the 70,000 pounds of gates, sprues, etc. for remelting does not change the cost figure, $1,285.51. It has cost this amount of money, in labor and expense, to produce the 310,000 pounds of castings, consequently the cost per pound becomes $\frac{1,285.51}{310,000} = \$0.00415$.

If the cost is based on the 400,000 pounds melted, additional and entirely unnecessary accounting is required to arrive at the final cost.

It is true, of course, that the question of melting losses and varying ratios of gates, sprues, runners, etc., to the castings produced will play a part in the accuracy of the cost, since these items directly affect the amount of metal to be melted for a given weight of good castings.

82. Some Assumptions Are Necessary.—The illustrations given, however, are based on the assumption of a reasonably constant ratio of gates, sprues and melting loss to the castings produced. The exact proportion of gates, sprues, etc., with the corresponding ratio of melting loss, can be determined for each class or order of castings, but in most instances the work required to obtain this information is not warranted considering the little that is gained. The point, however, must not be ignored when the unit cost for melting is being determined, since in foundries making both large and small castings, this factor may have a marked effect upon the accuracy of the unit cost.

83. The Metal Cost.—Turn now to Form 37–8*a*, on which is developed the data taken from Form 20. The items of metal, weights and percentages are listed in detail, as a matter of statistics and control, together with the values of the metal melted. This metal sheet, Form 37–8*a*, is divided between metal accounting and cost accounting, because there is a difference in the application of the two. Only part of the metal melted is to be found in the castings. The balance—bad castings, gates, sprues and over-iron, must be credited and returned to the Pig and Scrap Account. These items are taken from Form 20, and are as follows:

	Pounds
Bad or defective castings	30,000
Gates, sprues, etc	60,000
Return scrap	10,000
Total scrap	100,000

This amounts to 50 net tons which, at the scrap value of $16 per ton, amounts to $900. This $900 becomes a credit as follows:

Total cost of metal melted	$6,000
Less: Value return scrap	900
Net cost of metal in good castings	$5,100

84. An Important Difference.—Here there arises a difference in value between the returned scrap, at scrap value, and its original value when charged into the cupola. This is a loss and must be accounted for in the final pound cost. To show how this loss is accounted for through the totals, the following calculation is given:

The original value of the metal charged will be found on the foundry report summary, Form 20.

Pig iron	150 tons at $34		$5,100
Scrap	50 tons at $18		900
Total	200 tons		$6,000
Cost per ton of mix	$30		
Scrap Returned:			
Original value at mix price	50 tons at $30	$1,500	
Scrap value	50 tons at $18	900	900
Loss by difference in value		$ 600	
Net cost of metal in good castings			$5,100

Thus the $600 loss, by difference in value, remains in the net cost of metal which is $5,100.

There is still a further loss of 5 per cent, through melting, amounting to 20,000 pounds or 10 tons, which has not been considered in the total scrap returned, but the value of which remains in the $5,100 net cost of metal. This melting loss, when added to the accounted-for scrap, makes a total of 120,000 pounds or 60 tons, thus leaving 140 tons or 280,000 pounds of good castings as shown on Form 20, and on the melting sheet in the analysis.

85. A Sample Calculation.

The cost of metal, at this point, for the 140 tons of Good castings amount to	$5,100
The original value of the 140 tons at the mix cost of $30, amounts to	4,200
Loss to be absorbed in final pound cost	$ 900

If the 140 tons of metal in the good castings were taken at the mix value of $30, amounting to $4,200, there would be an unaccounted-for loss of $900, and the cost would be too low unless additional percentages be considered to account for such losses.

If the 140 tons are figured at the net value of metal, $5,100, this $900 loss will be absorbed into the final cost per pound of good castings. The cost per ton will then be $36.4286 instead of $30.

$$\$36.4286 - \$30 = \$6.4286$$
$$140 \times 6.4286 = \$900.00$$

It will be noted that all return scrap has been figured at scrap value, because that is all it will bring if sold. Some foundries take this scrap, which they daily remelt, at the mix value because it contains approximately the same mixture as the castings to be produced. This point of view is natural, but that method of pricing will change the above calculation because the scrap credits will be at the same prices per ton as the mix and there will be no loss by difference in values, to be absorbed.

86. What Value for Scrap.—Taking scrap at scrap value is to be preferred as a method of metal accounting because if as sometimes happens, it is sold it will bring only the market price and the difference would show a loss in inventory.

Accounting for the metal cost in totals, taking the scrap at scrap value, eliminates the use of percentages and the resulting additional calculations in costs.

87. Two Journal Entries.—The entries in the general ledger for the metal accounting are covered by two journal entries. The total amount of pig and scrap drawn from stock and melted becomes a debit to the Goods in Process Account and a credit to the Pig and Scrap Account. The total amount of scrap accounted for becomes a credit to the Goods in Process Account and a debit to the Pig and Scrap Account. This leaves in the Goods in Process Account the net cost of the metal and the scrap is carried back into the Pig and Scrap Inventory.

While this accounting for metal takes care of the totals in the general ledger, the cost accounting deals with those totals which enable us to determine the unit cost of metal in the finished castings.

The net cost of metal, $5,100, however, is not used for cost purposes. The application of metal costs differs, since the unit cost is based on the total castings produced.

The cost of the total metal melted is $6,000. The amount of melting loss, 20,000 pounds, deducted from the weight melted, 400,000 pounds, leaves 380,000 pounds which is the total metal accounted for. But this deduction does not change the original cost of $6,000.

88. The Cost Calculation.—Since the unit cost is based on the total of good and bad castings produced, the bad castings must not be deducted until the cost by classification or order is determined. Therefore the next step is to deduct the weight of gates, sprues and over-iron, 70,000, at the scrap value of $630, which gives the weight of the good and bad castings as 310,000 pounds, and the net cost of metal in all castings, as $5,370. The cost of metal per pound for all castings then becomes: $\frac{5,370}{310,000} = \$0.01732$. This pound cost figure, $0.01732, may be considered the base cost with 100 per cent good castings.

The form of cost calculation as applied to an order, will be as follows:

	Pounds	
Total castings	310,000 at $0.01732	$5,370
Bad castings (scrap credit)	30,000 at $0.009	270
Good castings	280,000	$5,100
Cost per pound of good castings		$0.01821

In some foundries the cost is based on the pounds melted with a percentage added to account for the intermediate losses. If this be done, additional calculations at once become necessary and the accounting would be as follows:

	Pounds	
Total metal melted	400,000	$6,000
Metal cost per pound melted		0.015
Melting loss	20,000	5%
Metal accounted for	380,000	
Gates, sprues, etc	70,000	
All castings produced	310,000	
Metal melted per pound, all castings	1.2903	

Using this method with the analysis totals as it would be applied to an order cost, the calculation is:

All castings produced	310,000 × 1.2903	400,000 pounds
Metal melted	400,000 × 0.015	$6,000
Melting loss, 5 per cent	20,000	
Metal accounted for	380,000	$6,000
Scrap credit	100,000 at 0.009	900
Good castings	280,000	$5,100
Cost per pound good castings		$0.01821

This method gives the same result but is more complicated and increases the possibility of errors.

The melting loss in the cupola is the same for all metal. We have assumed, for the sake of simplicity, that the gates, sprues and over-iron bear a constant ratio to the weight of castings produced. This, however, is not always true; but it would not be practicable, in many foundries, to determine the actual weight of gates, sprues and runners for each classification of castings or for each order.

89. Where Small Castings are the Rule.—In a foundry, however, whose castings are all small, particularly gated work, the gates and sprues will often weigh half as much as the castings. In some they may even equal or exceed the weight of the castings. These conditions are frequently found in malleable and brass foundries.

When these conditions exist the cost per pound cannot be determined on the basis of good and bad castings alone, but must be determined on the basis of the weight of all castings including the gates and sprues. Then the scrap credit would be made up of bad castings and gates and sprues. The gangway iron, over-iron, etc., would have to be considered as a whole, as it would be quite impracticable to determine this by classification or order of castings.

These points are of vital importance in the determination of correct costs and cannot be overlooked.

90. A Common Error.—Figuring the cost per pound on the basis of good castings produced and then adding a percentage to cover the loss on an order, or by classification, is a not uncommon practice. To illustrate this practice, the cost per pound of good castings, $0.01821 given above, will be used. A foundry may find that out of the weight of total castings, 310,000 pounds, 30,000 pounds were bad. The calculations which is sometimes used follows:

$$\frac{\text{Bad castings} \ldots\ldots\ 30{,}000}{\text{Total castings} \ldots\ldots\ 310{,}000} = 9.68 \text{ per cent}$$

This percentage is then added to the cost per pound of good castings to give a total cost per pound, $0.01997.

Obviously this method is not correct. If costs were figured on this basis the controlling account in the General Ledger would never be right.

In the first place the above percentage is incorrectly determined. To determine the cost it is necessary to know the ratio of bad castings to good castings.

$$\frac{\text{Bad castings} \ldots\ldots\ 30{,}000}{\text{Good castings} \ldots\ldots\ 280{,}000} = 10.71 \text{ per cent}$$

This means that in order to get 280,000 pounds of good castings it has been necessary to make 10.71 per cent more than this amount, or 30,000 pounds, which gives the 310,000 pounds total.

Taking the cost per pound of all castings as $0.01732 and adding the 10.71 per cent of loss, gives the cost per pound of good castings as $0.01917.

91. What a Wrong Method Will Do.—The difference in these applications becomes still more apparent when applied to the original order for ten castings with varying percentages of loss.

Here is how it works out when 20 per cent loss is assumed:

Pounds good castings	1,000	
Pounds bad castings	200 20 per cent bad to good	
Total castings	1,200 at $0.01732	$20.784
Scrap credit	200 at $0.009	1.80
Good castings	1,000	$18.984
Cost per pound good	0.018984	

If we use the percentage application the result will be:

Cost per pound, all castings	$0.01732
Plus 20 per cent loss	$0.00346
Cost per pound good	$0.02078
The difference in the pound cost is	$0.001796

If the production amounts to 10,000,000 pounds, the difference would amount to 10,000,000 × $0.001796 = $17,960.

These differences become more pronounced as the percentage of loss increases. For instance, with a 30 per cent loss on this same order:

Pounds good castings	1,000	
Pounds bad castings	300 30 per cent bad to good	
Total castings	1,300 at $0.01732	$22.516
Scrap credit	300 at $0.009	2.70
Good castings	1,000	$19.816
Cost per pound good	$0.019816	

When making the percentage application, the result will be:

Cost per pound all castings	$0.01732
Plus 30 per cent loss	$0.00519
Cost per pound good	$0.02251

The difference in the pound cost is here equal to $0.0027. If this difference in the cost per pound be applied to the production of 10,000,000 pounds, the money involved will amount to 10,000,000 × $0.0027 = $27,000.

92. The Error of Using Averages.—It is thus apparent that when this percentage basis is used, the result will be to give very incorrect prices; to say nothing of the inaccuracies which will result in the Goods in Process Account in the ledger.

Let us figure the melting and metal cost for the sample order for ten castings weighing 100 pounds each.

10 castings at 100 pounds	1,000 pounds
10 castings made good	1,000 pounds
2 castings made bad	200 pounds (loss 20 per cent)
Total castings	1,200 pounds

The cost per pound from the analysis is:

Labor cost	$0.00113	
Expense cost	$0.00302	
Total melting labor and expense		$0.00415
Metal cost, mix at 30 per ton		$0.01732

The cost should next be shown in detail as follows:

Items	Pounds	Metal unit cost $	Metal cost $	Labor		Expense		Total cost $
				Unit	Total $	Unit	Total $	
Metal all castings	1,200	0.01732	20.784	0.00113	1.356	0.00302	3.624	25.764
Scrap credit	200	0.009	1.80	....	....	....	....	1.80
Totals	1,000	....	18.984	....	1.356	....	3.624	23.964
Good castings	1,000	....	0.018984	....	0.001356	....	0.003624	0.023964

To estimate on this job, anticipating a loss of 20 per cent, the calculation would be as follows:

Weight of good castings	1,000 pounds
Estimated loss, 20 per cent	200 pounds
Total castings	1,200 pounds

Metal cost at $0.01732	$20.784
Melting cost at $0.00415	4.98
Total	$25.764
Scrap credit at $0.009	1.80
Net cost	$23.964
Cost per pound	$0.023964

It is to be noted that this cost covers only the metal and includes the labor and expense for melting it. The cost of cores, moulding, cleaning, etc., will be developed as the succeeding departments are considered.

93. Estimating.—In the above figures the iron cost has been kept separate from the cost of melting. When estimating it may be necessary to use new market prices for the metal so that instead of $30 per ton of mix, we may need to use $35 per ton of mix. This would then require an adjustment in the metal cost to meet the market price of pig and scrap.

The calculation will then be as follows:

Original cost per ton of mix	$30.00
New cost per ton of mix	35.00
Increase cost per ton of mix	$ 5.00
Per cent, increase	16.7
Original metal cost per pound	$ 0.01732
16.7 per cent adjustment	0.00289
New pound cost for estimate	$ 0.02021

The calculation on the metal sheet of the expense analysis would be as follows:

200 tons of mix at $35	$7,000
Scrap credit (gates, sprues, etc.) $21	735
Cost of metal, all castings	$6,265
Weight castings produced	310,000 pounds
Cost per pound, all castings	$0.02021

The correctness of the percentage application method is proved by the fact that the cost per pound checks in these two calculations.

With a declining metal market the reverse calculation would, of course, be necessary.

Using the above method of accounting for the market fluctuations in the price of metal will be found particularly valuable when costs have been collected on ranges, stoves, heaters and similar standard articles. The standard cost may remain constant when provision is made for adjusting the metal cost, providing that the costs in the other departments remain constant.

CHAPTER X

GETTING THE OVERHEAD INTO THE PRODUCT

Looking at it in one way, the Core Room might be considered as contributory to the Moulding Department, but since it performs work which can be directly charged to each casting, it is best to treat it as a productive department.

On the expense analysis, Form 37–9, the items of expense incurred directly by the Core Room and the shares of expense of the contributory departments are gathered.

94. The Core-making Expense.—The materials used in the Core Room, such as sand, core oils, compounds, flour, molasses, etc., are the direct materials, but are not the type of direct materials which will be found in the finished casting, and so cannot be treated the same as iron which is the real direct material in the product. Usually, the purchase of the core materials is in such quantities that the charge may be made direct to the department through the charge register, the charges being monthly debits to the Manufacturing Expense Account and shown on the expense analysis. This greatly simplifies the accounting and avoids requisitioning in small quantities from stock.

A three or four months' supply of sand is frequently purchased at one time, so the charge is made to the Sand Inventory Account and the amounts used during each month reported, so that the actual consumption can be charged to the Manufacturing Expense Account and credited to the Inventory Account.

With these supplies included in the expense of the department, the monthly total is found to be $1,123.17. Adding the direct core-making labor gives a labor and expense total of $1,823.17. This, divided by the total weight of castings produced, gives a base cost per pound, in the same way as was used in determining iron costs. This method is reasonably accurate in foundries making a fairly uniform type of castings or whose castings can be divided into a few classes. It is especially good where one class of castings is made, though instances may arise where an entirely different unit may be necessary. In foundries doing a general jobbing business, care must be used in determining the core cost for the job. This requires more detailed accounting and with this method we are forced to consider that most jobbing foundries make a supply of stock, round and square, cores of various sizes, which offers an additional problem in cost determination.

95. Alternative Methods.—In order to illustrate the workings of the analysis, two ways of arriving at a unit cost are shown:

(*a*) Percentage of total core-making expense to direct core-making labor.

(*b*) Base core cost per pound of total castings produced. The first method may well be used in a foundry having a marked variance in the class of castings and consequently little similarity in the kind of cores. It requires reporting the time of the core-maker or the piece price for each core made, in order to determine the direct core-making labor.

Here is how the first method works on a given core, which costs for direct labor, $0.27. To this must be added a share of the core-room expense covering the miscellaneous labor, sand, supplies, fixed charges and contributory charges. This, as shown on the analysis, is 161 per cent of the labor, or $0.435, making a total cost for labor and expense of $0.705, which is the total manufacturing cost of the core.

96. When the Castings are Uniform.—For an example of the second method, let us assume a foundry making a uniform class of castings, or a jobbing line which can be readily classified.

If the foundry makes, say, radiation only or automobile cylinders only, the core cost may be on the basis of good castings produced. If a variety of castings which can be grouped in classes, the core cost per pound of all castings produced (good and bad) is determined, together with the

loss by classification, and so arrive at the core cost per pound of good castings by classifications.

Let us assume that the cost of cores is to be determined by using the base cost method as shown on the analysis. This base cost per pound amounts to $0.0059 of which $0.0023 is labor and $0.0036 for expense.

The loss calculation on the sample order for ten 100-pound castings, is:

Making cost, on 1,200 pounds of castings:

Labor at $0.0023	$2.76
Expense at $0.0036	4.32
Total cost	$7.08 for 1,000 pounds good castings

The estimate would be made like this:

1,000 pounds castings ordered
20 per cent estimated loss
1,200 pounds castings to make, to get 1,000 pounds good
Core labor and expense per pound, $0.0059
1,200 pounds × $0.0059 = $7.08

With the cost from the Melting and Core Departments determined, we may summarize the collected manufacturing costs:

	Labor	Expense	Material	Total
Melting	$1.36	$3.62	$18.98	$23.96
Cores	2.76	4.32	.....	7.08
Total	$4.12	$7.94	$18.98	$31.04

Remember that the cost of castings is not the only thing provided for in the expense analysis. The monthly fluctuation of unit costs and percentages should be constantly watched if greater economies and full returns are to be realized from the use of such an analysis.

97. The Moulding Department.—The items making up the expense of the Moulding Department are listed in the same order as those of the other departments and the list of expense items varies only in the kinds of supplies used.

Moulding sand is one of the most important items listed. It is not difficult to account for the sand actually used, but the way to proportion its cost to each kind of casting is not so apparent.

It may seem logical to distribute the cost of sand on the basis of the amount of metal poured, since more sand is destroyed through contact with molten metal than from any other cause.

The other items of expense, however, cannot be distributed on this basis, so an extra calculation would be necessary. It is seldom necessary to use more than one basis of expense distribution in this or other departments. If different methods of expense distribution seem necessary, the department should be carefully divided into two or more smaller departments, so that a more accurate basis may be determined.

98. The Sand Cost.—Here we prefer to distribute the sand cost with the other items of moulding expense. If the direct labor is the basis, it is assumed that the amount of sand used is in approximate proportion to the labor necessary to ram up the flasks. Granted that a small complicated pattern with backdrafts and undercuts will require more direct labor for a small amount of sand than would a large, simple pattern, requiring a greater amount of sand. But experience shows that the error involved by such variations is too small to worry about, when the big saving in clerical effort is considered.

No matter which method is used, there will always be some slight inaccuracy. We want simplicity as well as accuracy and that method which will give the best degree of practical accuracy with the least complication and red tape is the one which experience has proved most satisfactory. The method adopted must be the result of a careful engineering study by one thoroughly experienced in manufacturing problems as well as cost accounting procedure.

About the simplest methods which give a proper refinement in moulding costs, are those in which the expense is distributed on the basis of the direct labor dollar, direct labor hour, machine hour or the units produced.

In the method we have chosen for this typical foundry, the sand is included in the total expense, which is distributed on the basis of the direct moulding labor, that is, as a percentage of expense to the direct labor.

99. The Moulding Labor.—In a jobbing foundry, the amount of moulding labor must be reported for each job and a share of the department expense added to give the labor and expense cost. If the castings can be classified into a few groups the method is greatly simplified, because a pound cost can be determined for each classification. This application is quite correct and can invariably be applied where the moulding is on a standard product, but with the general run of jobbing work few foundries will lend themselves readily to classification of castings and the method which will fit the local conditions best must be applied.

In a foundry where the helpers are employed continually with the same moulders, their labor is unquestionably direct, but if moulders' helpers serve several moulders, wheel in sand, etc., their labor is non-productive and therefore a part of the expense of the department. This simplifies the collection of labor costs and still keeps within the range of practical accuracy. Charging this labor to expense should not be done offhand as it may lead to an unbalanced distribution of the expense. It is far better to re-classify the labor into definitely assigned tasks where possible.

100. Where Moulding Machines Are Used.—If a foundry is so equipped that there are several classes of moulding, it may be desirable to divide the Moulding Department into two, three or four sub-departments. If a large part of the product is made on moulding machines which are served constantly by an overhead crane, this portion of the moulding floor must be set up as a sub-department with the moulding cost spread on the machine hour basis. Bench work, combined possibly with light floor work, should constitute another sub-department and so on.

The department layout will, of course, depend upon the conditions in the individual plant and must be determined by one who understands how the manufacturing conditions affect cost methods. If such a departmental division is based on mere generalities and assumptions by an unskilled person, the resulting costs will more than likely be valueless.

The moulding floor of the typical foundry we are describing has been set up as a single department in the expense analysis.

101. A Calculation.—Using the expense ratio of 84.6 per cent shown on the expense analysis, the moulding cost of the ten 100-pound castings on the order we are following is:

Moulding labor cost per casting, say	$1.00
Expense to labor, 84.6 per cent	0.846
Labor and expense cost per casting	$1.846
Castings made good	10
Castings made bad	2
Total castings made	12

Total moulding cost, all castings 12 × $1.846 = $22.15 or:

10 castings good, at $1.846	= $18.46
20 per cent loss	= 3.69
Total moulding cost	= $22.15

Analyzing this cost:

	Labor	Expense	Total
Cost each casting	$ 1.00	$ 0.846	$ 1.846
12 castings made	$12.00	$10.15	$22.15

To estimate we would proceed as in the previous departments:

12 castings at $1 each	$12.00
Expense at 84.6 per cent	10.15
Total labor and expense	$22.15
Estimated moulding cost for 10 good castings	$22.15

Summarizing all collected departmental costs so far, we have:

	Labor	Expense	Material	Total
Melting	$ 1.36	$ 3.62	$18.96	$23.96
Cores	2.76	4.32	.....	7.08
Moulding	12.00	10.15	.....	22.15
Total	$16.12	$18.09	$18.96	$53.19

This amount, $53.19, is the manufacturing cost at this point in the process.

102. The Cleaning Department.—The items of expense on the expense analysis of the Cleaning Department, Form 37–11, differs only in detail from those of the other productive departments.

In a large plant, the cleaning equipment may be so extensive and varied that it may be necessary to classify it and divide the department into sub-departments. The equipment may consist of a battery of rumblers or tumbling barrels, a battery of sand-blast units, a group of grinders and chippers, etc. The class of castings made will also affect the need for further sub-division of the Cleaning Department. If the castings are fairly uniform, sub-dividing the department may be unnecessary; but with a wide variety, several sub-divisions may be required. This is evident when we consider the cleaning of a 1,000-pound casting with pneumatic chipper and sand-blasting, possibly scratch-brushing, requiring an hour's time as compared with a 300-pound casting of a higher finish, with ornamental details, needing more careful handling, which also requires an hour's time to clean. If the rate per hour be 60 cents, the 1,000-pound casting would show a labor cost of $0.06 per 100 pounds, and the 300-pound casting would cost $0.20 per 100 pounds.

The cleaning cost of a uniform product such as radiation or straight stove plate is comparatively simple, merely arriving at a total cleaning shop cost per unit or per pound. It may be necessary however, to consider breakage loss with the different classes of castings, and arrive at a cleaning cost by classification.

103. For the Large Concern.—In the large foundry there is a better opportunity for classifying the labor so that it is grouped into definitely assigned units, but in small and even medium sized foundries, it is not uncommon to find part of the cleaning shop labor used in the foundry to help pour off. When this is done, care should be taken to record such labor transfers so that the proper credit may be given to the Cleaning Department payroll and the amount charged to the miscellaneous labor in the Moulding Department. This is not necessary when conditions permit organizing the labor into moulding, pouring, shake out and cleaning groups. It is the use to which labor is put which determines how and where the charge shall be made.

The typical foundry which we are describing in this book is one making a fairly uniform type of casting, therefore the cleaning is a single department.

The cost application is therefore as follows:

Total cleaning expense	$ 914.82
Total cleaning labor	700.00
Total labor and expense	$1,614.82
Pounds good castings cleaned	280,000
Labor cost per pound	$ 0.0025
Expense cost per pound	0.0033
Total labor and expense cost per pound	$ 0.0058

Analysis of this cost to the order of 10 castings which we are following, is:

	Labor	Expense	Total
Cleaning:			
Cost per pound good castings	$0.0025	$0.0033	$0.0058
1,000 pounds good castings	2.50	3.30	5.80

To estimate we would proceed according to the same method described for the other departments.

Summarizing, so far, the costs on this order for 10 castings, gives:

	Labor	Expense	Material	Total
Melting	$ 1.36	$ 3.62	$18.98	$23.96
Cores	2.76	4.32	......	7.08
Moulding	12.00	10.15	......	22.15
Cleaning	2.50	3.30	......	5.80
Total	$18.62	$21.39	$18.98	$58.99

In presenting these unit cleaning costs it is assumed that the two defective castings on the order were found bad on the moulding floor and no cleaning on them was done. However, if castings are not discovered to be defective until after they are cleaned, the cleaning cost on the defective castings will be absorbed in the pound cost of good castings cleaned and delivered.

104. Cleaning in a Malleable Foundry.—In the expense analysis, Form 37–11, only one Cleaning Department is shown. This serves to illustrate the method. In a malleable foundry, however, there would necessarily be two cleaning departments, namely, Hard Iron Cleaning and Soft Iron Cleaning.

The procedure in setting up these departments in the analysis would be the same as the one already considered for a Grey Iron Foundry.

It is necessary to remember, however, that in the malleable foundry some castings will go through both cleaning processes, others may not be tumbled at all, but the cleaning confined to Sand-blasting Hard Castings and Sand-blasting Soft Castings. The cost per unit cleaned may show considerable variation and again tests may show a reasonable uniformity in unit costs. Again, some castings go through the Hard Iron Cleaning but are not tumbled after annealing. Obviously, the cleaning in the last instance will cost approximately half as much as in the first case.

Correct reporting of product is very necessary under such conditions if the costs are to be correct. A general pound cost for cleaning in these instances would not be at all correct.

The importance of studying conditions, product and processes is plainly apparent in the Cleaning Department. It is the most important thing in devising a cost system to make the cost finding methods reflect the manufacturing methods. Correct reporting is an essential, yet it need not be laborious nor expensive.

While in the typical Grey Iron Foundry which we are describing there would not, of course, be an annealing department, we shall describe the procedure in such a department for the benefit of those needing it, as it brings up some new and difficult problems.

105. The Annealing Department.—Getting the total of the Annealing Department expenses as shown on Form 37–12 presents no new problems nor methods.

To find a basis for spreading the cost of annealing to the castings, however, presents a problem very different from those which have been previously considered. Usually, the cost of annealing is incorrectly determined.

We must again consider the class of castings produced. A foundry may turn out a uniform class of castings or it may produce a wide variety. In either case, if it be found possible to pack the castings in the annealing pots so that a uniform packing weight of say, 800 pounds can be regularly maintained, there is little question as to the reliability of the straight "cost per pound to anneal" basis; but if, because of variation in the class of castings annealed, it is impossible to maintain a uniform packing weight and the weight packed varies say, from 500 to 800 pounds per pot, the cost per pound basis will not give correct annealing costs.

Let us show, first the fallacy of the cost per pound basis. Assume that 10 castings of one kind weighing 30 pounds each can be packed for annealing in each pot. Orders indicate the need of 300,000 pounds of annealed castings; but the annealing equipment will permit of a production in excess of 300,000 pounds.

The expense analysis shows that the labor and expense for the month amounts to $1,302.38 which for 300,000 pounds annealed, gives a cost per pound of $0.00434.

106. Unitizing the Annealing Costs.—Now assume a second lot of castings weighing 30 pounds each, but of a shape and construction which will permit only five castings to be packed in one pot. That means that the same amount of space in the annealing ovens will accommodate but 150,000 pounds of castings with practically the same labor and expense. These castings may be more difficult to pack and require the same amount of time as the first lot.

The cost in this case will be $\frac{1{,}302.38}{150{,}000} = \$0.00868$ per pound to anneal.

Let us now assume that we have filled the same annealing space with half of each lot of castings. In this case we can anneal:

First lot of castings	150,000 pounds
Second lot of castings	75,000 pounds
Total	225,000 pounds

The cost will now be $\frac{1{,}302.38}{225{,}000} = \$0.0058$ per pound to anneal.

This last cost figure is an average pound cost for the two lots of castings, but is not correct for either lot. It would make one lot of castings carry too large a proportion of the cost and the other too little. If that figure were used in estimating and a large amount of the production were on the second lot, the paper profits on the order would be non-existent.

To solve this problem it is necessary to unitize the castings on the basis of the space they take up, because it is purely a question a space occupied by the castings which has caused the error. The solution lies in giving a unit value to each casting and applying the overhead at so much per unit.

The first lot can be packed 10 castings at 30 pounds each in a pot. We may therefore establish a "space pound unit" which makes each one of these castings represent 30 units.

In the second instance, only five castings at 30 pounds each occupy the same space. Therefore, the unit for this lot of castings will be double or 60 units per casting.

Of the first lot 10 × 30 = 300 units can be packed for annealing in one pot.

In the second instance can be packed 5 × 60 = 300 units.

107. A Sample Computation.—This means that 300 units of either or both castings can be packed in one box. The cost is figured like this:

First Lot:			
Units per casting	30		
Units per pot	300		
Number pots placed	500		
Total units		150,000	
Second Lot:			
Units per casting	60		
Units per pot	300		
Number pots placed	500		
Total units		150,000	
Total units placed		300,000	
Unit Cost Calculation:			
Total annealing labor and expense			$1,302.38
Total units annealed			300,000
Annealing cost per unit			$0.00434

Figuring the annealing cost for castings from the

First Lot:		
Castings, units each	30	
Cost per unit	$0.00434	
Cost to anneal each casting	$0.1302	
Weight each casting		30 pounds
Cost per pound to anneal	$0.00434	
Second Lot:		
Castings, units each	60	
Cost per unit	$0.00434	
Cost to anneal each casting	$0.2604	
Weight each casting		30 pounds
Cost per pound to anneal	$0.00868	

108. Need of Correct Units.—If the standard unit value of each casting is correctly determined the castings may be packed in any way, and the correct cost of each easily figured. The method will cover any foundry or any class of castings, without the necessity of classifying the castings. The cost should be determined on the basis of total units annealed, reporting with every heat the number of units good and the number of units bad, to arrive at a percentage of loss.

Let us now develop the annealing cost of the order of 10 castings of 100 pounds each.

The unit for each casting is taken as 100 on the assumption that the space occupied in the annealing pot by this 100-pound casting is in the same ratio as that of the 30-pound casting, *i.e.*, if a pot will hold 300 units, it will hold but 3 of these castings as against 10 of the 30-pound castings.

The development of the annealing costs is as follows:

Total annealing expense	$ 702.38
Total annealing labor	600.00
Total labor and expense	$1,302.38
Total units annealed	300,000
Expense cost per unit	$0.00234
Labor cost per unit	$0.002
Total cost per unit	$0.00434
The order cost:	
Units per casting	100
Annealing cost per unit	$0.00434
Cost to anneal each casting	$0.434
Weight each casting, pounds	100
Cost per pound to anneal	$0.00434
Annealing 10 castings at $0.434	$4.34

The analysis of this cost to the order will be.

	Labor	Expense	Total
Annealing cost per unit	$0.002	$0.00234	$0.00434
1,000 units on the order	2.00	2.34	4.34

Had this casting been of such a shape and construction that only two could be placed in a pot and with no room for any small pieces to bring the weight up to 300 pounds, the cost per pound would increase because the unit for this casting would be 150 instead of 100, producing a cost of $0.651 instead of $0.434.

Summarizing all of the costs on this order so far:

	Labor	Expense	Material	Total
Melting	$ 1.36	$ 3.62	$18.98	$23.96
Cores	2.76	4.32	......	7.08
Moulding	12.00	10.15	......	22.15
Cleaning	2.50	3.30	......	5.80
Annealing	2.00	2.34	......	4.34
Total	$20.62	$23.73	$18.98	$63.33

109. The Machine Shop Costs.—The last of the productive departments is the machine shop whose expense analysis, Form 37–13 is developed in the usual way.

It is not the purpose in this discussion to dwell upon the subject of machine shop costs in detail because cost finding in the machine shop is a subject as large in its details and application as that of cost finding in the foundry. This department is included, however, because so many foundries operate a machine shop.

The productive labor dollar has been selected in this case as the basis of expense distribution. It is to be remembered, however, that this method will not always hold good because varying conditions and types of equipment will make necessary the use of other methods. For instance, the "man hours," "machine hours" or "units" may be the required basis for determining costs. A machine shop of any size will itself be divided into a dozen or so departments.

The expense analysis sheet shows the following items:

Total machine shop expense	$1,401.88
Total direct labor	2,000.00
Per cent expense to labor	70

110. The Cost of Machine Work.—To arrive at the cost of machine work on a job, time cards similar to Form 48 should be used for each operation or each piece. All other labor in this department should be accounted for in the same way. Such labor is classed non-productive or indirect and it is accounted for precisely as described in the chapter on labor. The same time card, Form 26 should be used.

The productive time card, Form 48, shows that the machine work for each casting on the original order for 10 castings amounts to $1.

The cost calculation for these castings will be as follows:

10 castings machined and assembled:	
Labor, $1 each	$10.00
Expense, 70 per cent	7.00
Total labor and expense	$17.00
Assembly material (bolts and screws)	0.60
Total machine cost	$17.60

111. The Total Cost of an Order.—The summary of all previously collected departmental costs may now be made so that we may determine the total manufacturing cost of the castings on the original order.

	Labor	Expense	Material	Total
Melting	$ 1.36	$ 3.62	$18.98	$ 23.96
Cores	2.76	4.32	......	7.06
Moulding	12.00	10.15	......	22.15
Cleaning	2.50	3.30	......	5.80
Annealing	2.00	2.34	......	4.34
Machining	10.00	7.00	0.60	17.60
Total castings	$ 30.62	$ 30.73	$19.58	$ 80.93
Patterns	100.00	98.82	40.00	238.82
Total cost	$130.62	$129.55	$59.58	$319.75

The above tabulation shows the total cost of the castings to be $80.93. In the Pattern Department, Form 37–4 of the analysis, it was shown that patterns were made on direct orders, which were to be charged to the customer. This pattern cost, $238.82, was therefore credited to Manufacturing Expense and debited to the Goods in

Process Account. Assuming now that this pattern charge is to apply on the order for ten castings, this cost is collected with the cost of the castings as shown in the above table. This gives a total cost on the order amounting to $319.75.

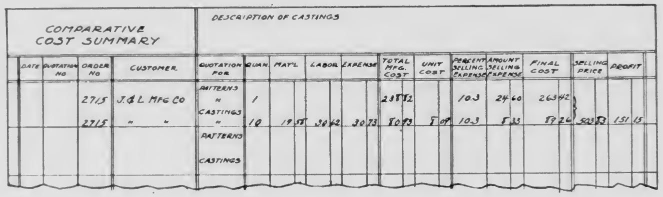
There is yet the application of shipping and selling expense, which will be discussed in a succeeding chapter. When this is applied it will give the final cost of the product.

CHAPTER XI

FIGURING THE SELLING PRICE

As each productive department has been discussed we have shown how the proper share of that department's expense has been added to the cost of the order for 10 castings which we have been following.

These figures are, in actual operation, gathered on the cost collection sheet, Form 49. The form for this purpose will have to be designed to fit the individual foundry. This one will do for a foundry turning out miscellaneous castings.



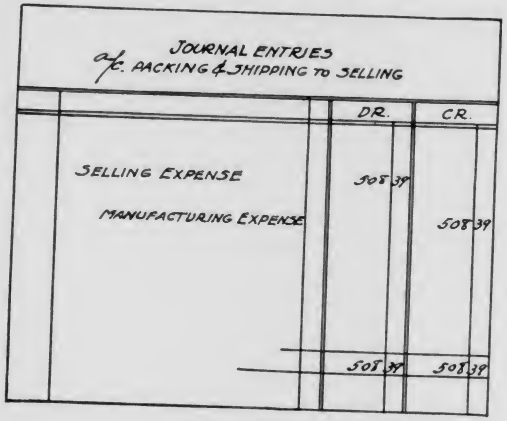
COMPARATIVE COST SUMMARY				DESCRIPTION OF CASTINGS											
DATE	QUOTATION NO	ORDER NO	CUSTOMER	QUOTATION FOR	QUAN.	MAT'L	LABOR	EXPENSE	TOTAL MFG. COST	UNIT COST	PERCENT SELLING EXPENSE	AMOUNT SELLING EXPENSE	FINAL COST	SELLING PRICE	PROFIT
		2715	J.&L MFG CO	PATTERNS ″	1				238 82		10.3	24 60	263 42		
		2715	″ ″	CASTINGS ″	10	19 58	30 62	30 73	80 93	8 09	10.3	8 33	89 26	503 83	151 15
				PATTERNS											
				CASTINGS											

FORM 50.

Form 49 shows the manufacturing cost of the 10 castings to be $80.93. To this is added the pattern cost to give the total manufacturing cost. If the pattern cost is to be figured as so much per pound of the castings, it would be shown in the second column and then applied to the manufacturing cost in the "total" column. This feature is important when a large number of castings is to be made and part shipments are necessary.

112. Comparative Costs.—When repeat orders are received comparisons between former and present costs can be made on Form 50. The headings are self-explanatory, provision having been made for the quotation on patterns and castings separately, together with space for the follow up cost. There are also the items of manufacturing cost, final cost, selling price and profit on the order. It is important to know the profit or loss on orders or classifications of castings. Such comparative cost records are of exceptional value to any foundry conducting a general jobbing business.

Different forms of final cost records for foundries making standard lines of products will be shown in another chapter.



JOURNAL ENTRIES
a/c. PACKING & SHIPPING TO SELLING

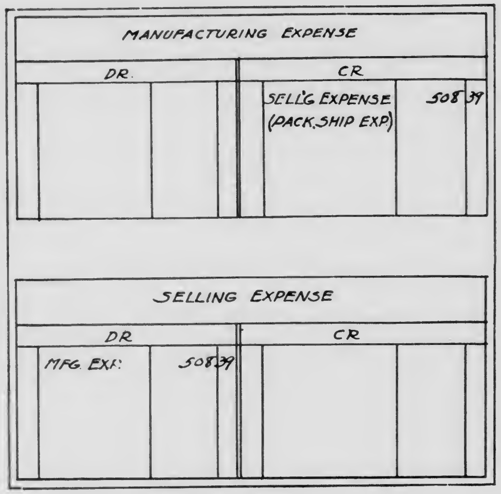
	DR.	CR.
SELLING EXPENSE	508 39	
MANUFACTURING EXPENSE		508 39
	508 39	508 39

Form 51.

Before setting a selling price it is necessary to add to the manufacturing cost now collected the expense of packing, shipping, and selling.

113. Packing and Shipping Expense.—Form 37–14 is the expense analysis for the Packing and Shipping Department, the entire expense of which is in this instance charged to Selling Expense. The resulting journal entries and ledger accounts as affected are shown on Forms 51 and 52.

Whether this method is to be followed depends entirely upon the nature of the business and its product. In a plant making a standard product which can be packed or crated before going in to finished stores, the Packing and Crating Expense should be considered a part of the manufacturing cost, a separate department for Packing set up and the labor considered as productive. Shipping would then be a department by itself and its total expense charged to Selling Expense in the ledger and applied to the cost on the pound basis, other Selling Expenses being applied as here on the cost dollar basis.



MANUFACTURING EXPENSE

DR.		CR.	
		SELL'G EXPENSE (PACK. SHIP EXP)	508 39

SELLING EXPENSE

DR.		CR.	
MFG. EXP.	508 39		

Form 52.

The resulting journal entries and ledger accounts as affected are shown in Forms 51 and 52.

Next, we must add to the cost, the selling expense which is gathered on Form 37–15.

114. The Selling Expense.—It is sometimes difficult to determine whether a certain item of expense is rightfully chargeable to manufacturing or selling. If a finished stock room exists, *it* is the point at which the manufacturing expense should end. If there is no finished stock room, the rule is that the manufacturing expense stops where shipment begins.

The items making up the selling expense in the expense analysis will differ for each business. The usual divisions are approximately as shown. There is no question about the direct salaries of the selling executives, clerks and salesmen, nor of traveling expense for the salesmen.

Advertising for the direct promotion of sales is likewise a direct charge as the expense is measurable. Catalogs and circulars may be disposed of directly, *i.e.*, as the expense is incurred, or by prorating over a period of two or three years if a supply to last that long is bought at one time. It would be obviously unfair to charge into the expense for one month an expenditure which will benefit selling for years to come.

Donations may be considered as a form of advertising and therefore charged to selling expense. Sometimes, though, these amounts may be absorbed proportionately by manufacturing and selling. Good judgment must govern the disposition of many such items of expense.

Commissions on sales are in effect an incentive, to boost selling, and consequently are chargeable to selling. If they are paid on general sales the amount may be applied as a part of the General Selling Expense, but if on a few articles only—or if there is a variation in the percentage of commission paid—they must be considered as a separate item of cost on the article sold, and not included with the General Expense items. The articles on which the commissions are paid should carry the charge as a direct expense.

Royalties are shown as an item in the General Selling Expense, making all of the product bear an equal share. If, however, royalties are payable on only a few of the articles made, these articles alone should carry this expense into their final cost. When this is the case, as with commissions, the General Selling Expense should be determined less the royalties. This item of expense will not be incurred with the average foundry.

Freight allowed is an expense not uncommon to selling. Frequently a degree of latitude is given a salesman so that he may be in a position to make some inducement for consummating sales. In doing so, the freight charges may be allowed and the expense thus incurred is chargeable direct to selling.

The expense of exhibits is a form of advertising directly chargeable to selling.

Miscellaneous expenses cover small expenses which may not be chargeable to other items listed in the analysis. This item should be watched, however, so that it may not become too large and thus develop into a resting place for items which it might be very important to list and watch from period to period.

115. The Total Selling Expense.—Adding the share of the General Office and the Packing and Shipping Expense gives a total selling expense of $2,061.90. The total net sales are given as $30,000 with the percentage of expense to sales at 6.87 per cent, which is equivalent to 10.3 per cent on the manufactured cost. The 6.87 per cent is only a guide and is not to be used in figuring the final cost.

The cost of goods sold plus the Selling Expense gives $22,061 as the total final cost of the castings shipped and billed during the month.

Twenty thousand dollars is shown on the chart of accounts, Form 2, as a credit to the Goods in Process Account and a debit to the Cost of Goods Sold Account. This amount is the total manufacturing cost for all of the castings shipped and billed during the month. The selling expense, amounting to $2,061.90, is also shown on the chart of accounts, made up of three entries. The sum of the debits to these two accounts gives the total final cost of all castings shipped and billed for the month and is the amount given above, $22,061.90.

On Form 49, is shown the total manufacturing cost of the order for 10 castings. The final cost of it is $319.75 plus 10.3 per cent for selling expense which equals $352.68.

116. A Better Method.—Figuring selling expense on the dollar basis, is not always the correct method of distribution. It may be necessary to distribute this expense on some unit other than the sales dollar. To illustrate:

Suppose that a certain line of product contains two items, one of which costs $50 and another $80 to manufacture.

It may require no more effort or expense to sell the $80 article than it does the $50 article.

If we use, from the selling analysis, the 10.3 per cent ratio of expense to cost of goods sold, the $50 article will cost:

Manufacturing cost	$50.00
10.3 per cent selling expense	5.15
Final cost	$55.15

while the $80 article will cost:

Manufacturing cost	$80.00
10.3 per cent selling expense	8.24
Final cost	$88.24

The second carries 60 per cent more selling expense than the first. This may be enough to prevent meeting competition.

If the unit of product is established as a basis for distributing the selling expense, the selling cost per unit may be $6.70. If each of these articles represent one unit, then the selling expense on each article would be $6.70, which would give as a final cost:

1st case:

Manufacturing cost	$50.00	
Selling expense	6.70	
		$56.70

2nd case:

Manufacturing cost	$80.00	
Selling expense	6.70	
		$86.70

Suppose a foundry manufactures a line of heaters in various sizes, with the manufacturing cost on Size No. 1 $200, Size No. 2 $300 and on Size No. 3 $400.

117. The Sales Dollar Fallacy.—It might require no more selling expense to sell size No. 3 than either of the others since a buyer would choose the one to fit his building. If selling expense is applied on the sales dollar, size No. 3 must carry twice as much as size No. 1. Here the unit should be the basis of distributing the selling expense. This unit should be "heaters sold," disregarding the question of size. When the product manufactured shows wide variations as to type, size and kind, this problem becomes more complex and consequently calls for a more detailed analysis in order to arrive at the proper basis of distribution.

Particular attention has been given to this element in costs because an incorrect distribution of selling expense may be the means of greatly curtailing the sales of some articles. A careful analysis is necessary for each plant and the application must be made to suit the individual case. No general rule can be applied with safety.

118. The Effort Required is the Measure.—In fact, the cost to sell an item is only measured properly by the effort required to sell it. Attempts, some successful and others entirely unsuccessful have been made to measure this effort. It is doubtful if an absolutely accurate method of charging selling expense by line or item of product can be found. In most businesses the procedure would entail tremendous study which would not, after all, be worth much. It is well, however, for each foundryman to study his own selling problems and if he finds that it would be easy to develop a selling cost per unit, to do so. It is comparatively easy when only a few standard lines are made even though there may be several sizes in each line. For the jobbing foundry it would be next to impossible.

For those few foundries selling standard lines, and having salesmen who cover territories regularly, we suggest that it may be well to set up an expense analysis for each salesman, territory or branch house, charging to each all of its own direct selling expense, and a share of the general selling expense.

119. The Cost per Call Method.—Then it is possible to develop a standard cost per call on prospects, against which the actual cost per call is compared monthly. Extravagantly high expense or low activity of the salesman will promptly show up in a rising cost per call.

The theory is that a large part of the selling expense is for the purpose of getting the salesman into the presence of the buyer. Whether the buyer purchases a $10 casting or a $100 one is more a question of what the buyer needs than what the casting costs. Therefore once a salesman makes a call, he is ready and presumably able, to sell the buyer anything the foundry makes that the buyer can use.

This method, in the few foundries to which it applies, can be refined to the point where the total selling expense will be divided and each part spread on a separate basis. The direct selling effort would thus go to make up a cost per call, the advertising would be charged proportionally to the territories as they benefited from it and the clerical cost of billing and bookkeeping for sales might be reduced to a cost per item bought. It costs no more to bill and account for an item of "10,000 castings as per drawing *A*41 estimated weight 55,000 pounds," than it does for an item calling for "1 manhole and cover—350 pounds."

We are merely suggesting this refinement of selling costs. We know it would be of value to certain foundries, but not, perhaps, to most.

The point is, that some figure fairly indicative of the cost of selling must be added to the manufacturing cost before the selling price can be set.

120. Adding the Selling Expense.—By the method already described we have found the final cost of the 10 castings which we have been following to be $352.68. Suppose a profit of 30 per cent of the selling price is wanted. It is incorrect, but common practice nevertheless, to add 30 per cent to the final cost. The correct way is to subtract the desired percentage of profit from 100 per cent and divide the total cost by the result. In this instance, therefore, the calculation is $352.68 divided by 70 which gives $503.83 as the selling price. You can prove that this gives a 30 per cent profit on the sales by dividing the selling price by the difference between the selling price and the cost.

The error which is frequently made is this:

Final cost	$352.68
30 per cent profit	105.80
Selling price	$458.48

The profit $105.80, is only 23 per cent on the selling price of $458.48. It is because of this error in figuring the selling

price that anticipated profits so often fail to materialize at the year's end.

Having developed the final cost and selling price of the order on Form 49 it is time to enter on the comparative cost record, Form 50, the final figures for the percentage selling expense, the amount of selling expense, the final cost, the selling price, and the profit.

This completes the cost record for this order with the use of the current month's figures.

The description of the use of the expense analyses in developing actual costs is now complete. The expense analyses give, as was stated in the beginning, a complete analysis by departments of the Manufacturing and Selling Expense accounts carried in the general ledger.

CHAPTER XII

TYING THE COSTS INTO THE GENERAL BOOKS

With each step so far taken in developing the costs, a proof sheet has been drawn, not only to prove the accuracy of the distributions, but to make clear the source and uses of all expense items. The resulting journal entries and the ledger accounts as affected by them have also been illustrated.

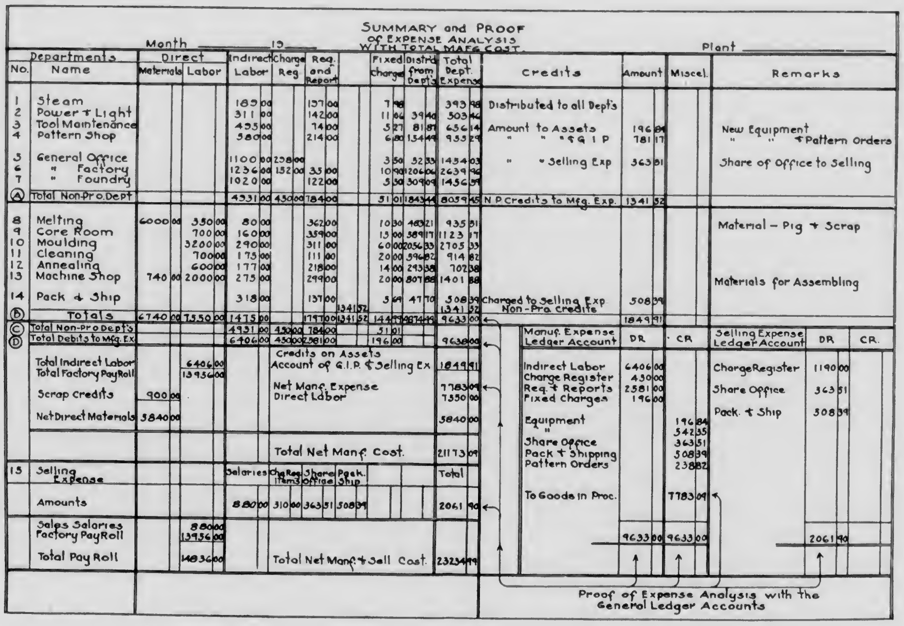
Several records were developed on which to analyse the expenses for entry upon the expense analysis. These records provide a means of checking all distributions when an audit is made, but separately they are not in the most convenient form. Therefore it is well to combine on Form 53 a summary of the charge register, Form 3; the charge register summary, Form 34; the fixed charge sheet, Form 5; the report summary expense materials, Form 14; the report summary direct materials, Form 16; the summary iron foundry report, Form 20; the analysis of supplies used, Form 21; and the payroll analysis, Form 31 or 32.

121. An Aid to Auditing.—The combined summary of these records, Form 53, provides greater convenience for auditing and at the same time serves as a form of graphic presentation of the operating expenses of all departments in the expense analysis. In addition, the direct materials and direct labor are included so that the total monthly cost of production and selling may be shown.

The amounts, under their respective headings, may be posted direct from the records listed above or may be taken from the expense analysis.

It is to be noted that all items above the line (*a*) belong to the non-productive or contributory departments whose expenses have been distributed to the productive departments, except for the amounts in the "credits" column

where charges have been made to Assets, Goods in Process and Selling, with the corresponding credits to the Manufacturing Expense Account.



SUMMARY and PROOF
of EXPENSE ANALYSIS
WITH TOTAL MAFG. COST.

Month ________ 19____ Plant ____________

No.	Departments Name	Direct Materials	Direct Labor	Indirect Labor	Charge Reg	Req. and Report		Fixed Charges	Distr'd from Dept's	Total Dept. Expense	Credits	Amount	Miscel.	Remarks
1	Steam			185 00		137 00		7 98		393 98	Distributed to all Dept's			
2	Power + Light			311 00		142 00		11 06	39 40	503 46				
3	Tool Maintenance			435 00		74 00		5 27	81 87	656 14	Amount to Assets	196 84		New Equipment
4	Pattern Shop			580 00		214 00		6 80	154 49	955 29	" " " & G I P	781 17		" " & Pattern Orders
5	General Office			1100 00	258 00			3 50	52 53	1454 03	" " Selling Exp	363 51		Share of Office to Selling
6	" Factory			1236 00	152 00	35 00		10 90	1206 06	2639 96				
7	" Foundry			1020 00		122 00		5 50	309 09	1456 59				
Ⓐ	Total Non-Pro. Dept			4931 00	450 00	784 00		51 01	1843 44	8059 45	N P Credits to Mfg. Exp.	1341 52		
8	Melting	6000 00	350 00	80 00		362 00		10 30	483 21	935 51				Material – Pig + Scrap
9	Core Room		700 00	160 00		359 00		13 00	589 17	1123 17				
10	Moulding		3200 00	290 00		311 00		60 00	2056 33	2705 33				
11	Cleaning		700 00	175 00		111 00		20 00	596 82	914 82				
12	Annealing		600 00	177 00		218 00		14 00	293 38	702 38				
13	Machine Shop	740 00	2000 00	275 00		299 00		20 00	807 88	1401 88				Materials for Assembling
14	Pack & Ship			318 00		137 00	1341 52	3 69	47 70	508 39 1341 52	Charged to Selling Exp Non-Pro Credits	508 39		
Ⓑ	Totals	6740 00	7550 00	1475 00		1797 00	1341 52	144 [illegible]	[illegible]	9633 00		1849 91		
Ⓒ	Total Non-Pro Dept's			4931 00	450 00	784 00		51 01						
Ⓓ	Total Debits to Mfg. Ex			6406 00	450 00	2581 00		196 00		9638 00				

	Direct Materials	Direct Labor		
Total Indirect Labor		6406 00	Credits on Assets Account of G.I.P. & Selling Ex	1849 91
Total Factory PayRoll		13956 00		
Scrap Credits	900 00		Net Manf. Expense	7783 09
			Direct Labor	7550 00
Net Direct Materials	5840 00			5840 00
			Total Net Manf. Cost.	21173 09

No.	Name	Salaries	Charge Reg Items	Share Office	Pack. Ship	Total
15	Selling Expense					
	Amounts	880 00	310 00	363 51	508 39	2061 90

	Direct Labor		
Sales Salaries	880 00		
Factory PayRoll	13956 00		
Total Pay Roll	14836 00	Total Net Manf. + Sell Cost.	23234 99

Manuf. Expense Ledger Account	DR	CR
Indirect Labor	6406 00	
Charge Register	430 00	
Req. + Reports	2581 00	
Fixed Charges	196 00	
Equipment		196 84
"		542 35
Share Office		363 51
Pack + Shipping		508 39
Pattern Orders		238 82
To Goods in Proc.		7783 09
	9633 00	9633 00

Selling Expense Ledger Account	DR	CR.
ChargeRegister	1190 00	
Share Office	363 51	
Pack. + Ship	508 39	
	2061 90	

Proof of Expense Analysis with the General Ledger Accounts

FORM 53.

The totals (*b*) have all been taken below the line (*a*) and include all distributed expenses from the contributory departments. On line (*c*), the totals from the non-productive departments have been carried down so that the total from all sources of expenses may be shown on line (*d*). The sum of the items on lines (*b*) and (*d*) equals the total debits to the Manufacturing Expense Account, $9,633, and for proof the credits have been added, then later deducted, so that the Net Manufacturing Expense may be shown.

122. Using the Summary.—The non-productive or indirect labor has been added to the direct labor, showing the total factory payroll. This amount, with the sales salaries, gives the total company payroll for the month.

The direct materials are shown opposite the departments in which these materials were used. The scrap credits are later deducted, giving the net materials used for the month.

The direct labor and net material cost are then carried to the "total" column under the item of "Net Manufacturing Expense" which, when totaled, gives the "Total Net Manufacturing Cost." The Selling Expense added to this amount gives the "Total Net Cost of Manufacturing and Selling," $23,234.99.

The details of all credits are listed in the credit column with an explanation as to what these credits were for in the "Remarks" column.

Duplicates of the Controlling Expense Ledger Accounts are shown to the right of the form with the entries in check with the totals on line (*d*) and the credits proving with the amounts above. The heavy indicating line directs attention to the entries and corresponding totals.

123. Condensing the Month's Transactions.—The direct material and direct labor are entries to the Goods in Process Account, as shown on the chart of accounts, Form 2.

This Form 53 gives the gross and net direct material and labor; the gross and Net Manufacturing Expense, the total Net Manufacturing Cost and Selling Expense, and the total Net Manufacturing and Selling Cost.

This summary gives in a condensed but complete form, the entire month's transactions, and is a convenient check when a general audit is made.

When such a summary is prepared, it is not customary to show the ledger accounts as illustrated. They have been included here to give a direct comparison and show how the total expenses of manufacturing and selling, as used in the expense analysis, check with the general ledger control.

Scattered throughout the preceding chapters of this book, as they logically came to notice, we have shown the journal entries needed, together with the effect of them on the ledger accounts. It seems well to summarize these steps here, preliminary to describing the closing entries for the period.

124. Summarizing the Work so Far.—For instance, we saw that all debits to the Manufacturing Expense Account originated in the charge register, Form 3, the fixed charge sheet, Form 5, the expense requisitions, Form 13, and the payroll analysis, Form 31 or 32.

The direct materials were accounted for by means of the productive requisitions, Form 15 and the foundry report summary, Form 20, and the productive labor through the payroll analysis, Form 31 or 32.

From these sources was built up the Manufacturing Expense Account and the Goods in Process Account.

But the Manufacturing Expense Account included not only those expenses involved by production but also certain items which were involved in assets. It was necessary to relieve it of these amounts, which were chargeable to New Buildings, New Equipment, Tools, Jigs and Fixtures, and Direct Orders. As this is an important and somewhat involved procedure it seems well to describe it again here.

The labor and expense incurred on work affecting any of these accounts, are entirely non-productive and consequently accounted for in total through the Manufacturing Expense Account. But when it results in additions to building, equipment or direct orders, the Manufacturing Expense must be credited so that the total cost of the work may be charged to the proper account.

125. The Book Entries.—In this instance we find that of the money spent for labor and expense, the following amounts become credits to Manufacturing Expense:

New Equipment	$131.23
Tools, jigs and fixtures	65.61

When material for such work is issued, it is charged direct to the Asset Accounts from the charge register, Form 3, without journalizing, or from the expense requisition, in which case there would be a journal entry. If the material specified for any New Equipment job is issued all at one time, its value is charged direct to the Asset Account, although the labor and expense involved may extend over a period of two or three months to follow, in which case the labor and expense would be capitalized only as it is collected at the end of each month. The total cost of the work or order for the new equipment is collected on the cost card, Form 41, and entered finally on the equipment record, Form 4.

In the Pattern Shop, the following items for journalizing are shown:

New patterns	$373.23
New equipment	169.12
Direct orders	238.82

As this work is also of a non-productive character it has been accounted for in total through Manufacturing Expense and must therefore be credited to this account and charged as follows:

	Dr.	Cr.
Assets:		
New patterns	$373.23	
New equipment	169.12	
Goods finished and in process:		
Direct orders	238.82	
Manufacturing expense		$781.17

Accounting for the details of this work is exactly the same as for the Tool and Maintenance Department.

126. Journalizing the Expense.—A portion of the General Office Expense is transferred to Selling. This, $363.51, accordingly becomes a credit to Manufacturing Expense and a debit to Selling Expense.

The entire expense of the Packing and Shipping Department is charged to Selling. This amount, $508.39, is therefore credited to Manufacturing Expense and debited to Selling Expense.

The journal entries which were listed and combined with the amount from the charge register, Form 36, shows a total debit to the Manufacturing Expense Account of $9,633.

The credits to this account, which have developed from the expense analysis and are described in the preceding paragraphs, are summarized:

New equipment	$ 739.19
Share, general office to selling	363.51
Packing and shipping expense to selling	508.39
Pattern orders to goods in process	238.82
Total credits	$1,849.91

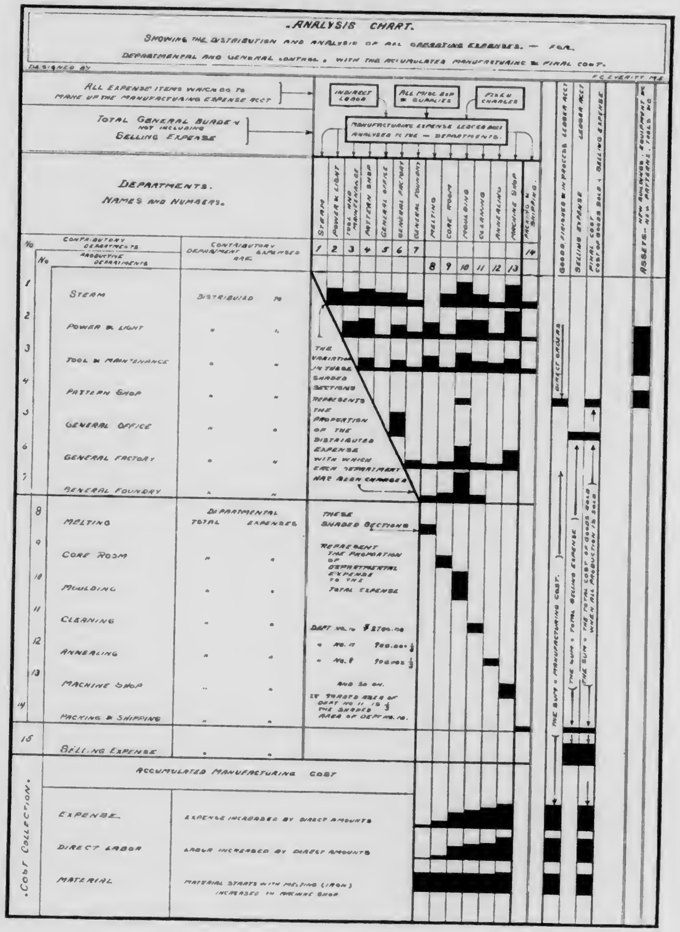
This leaves a balance in the Manufacturing Expense Account which represents the net expense required to manufacture for the month just closing and is the net sum of all expense items used in the expense analyses of the contributory and productive departments, from which the manufacturing cost is developed. The amount of this balance is:

Total debits	$9,633.00
Total credits	1,849.91
Balance	$7,783.09

With the close of the month, the Manufacturing Expense Account is balanced and the $7,783.09 is debited to the Goods Finished and in Process Account.

So much for the summary of what has been discussed at scattered points in this book. Let us see what remains to be done.

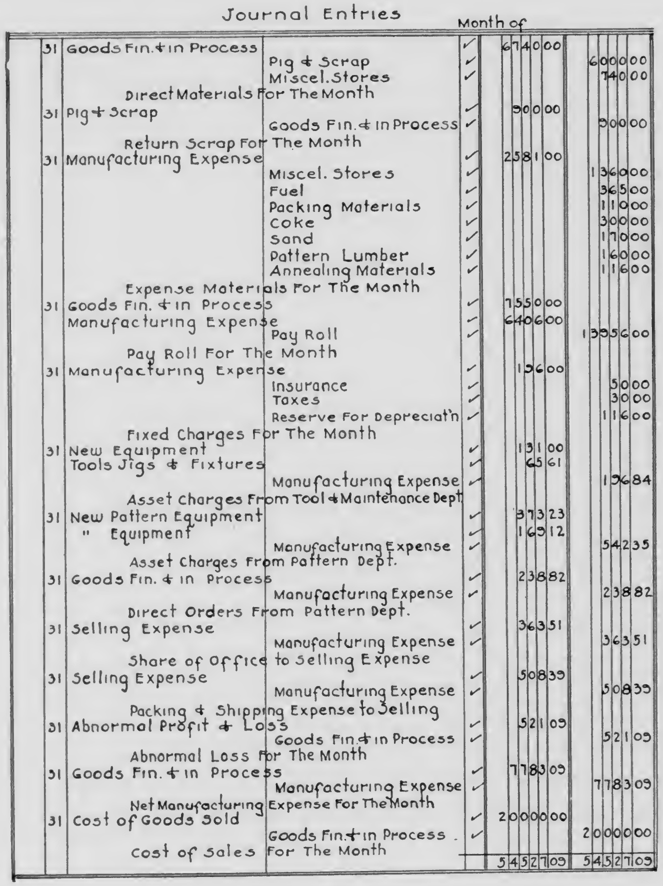
Each shipment during the month carries with it the cost of the sale. The sum of the costs of all sales gives the Cost of Goods Sold for the month. This amount is shown on the chart of accounts as $20,000, and it becomes a credit to the Goods Finished and in Process Account and a debit to the Cost of Goods Sold Account.


ANALYSIS CHART.
SHOWING THE DISTRIBUTION AND ANALYSIS OF ALL OPERATING EXPENSES. — FOR DEPARTMENTAL AND GENERAL CONTROL, WITH THE ACCUMULATED MANUFACTURING & FINAL COST.
DESIGNED BY F. C. EVERITT M.E.
ALL EXPENSE ITEMS WHICH GO TO MAKE UP THE MANUFACTURING EXPENSE ACCT
TOTAL GENERAL BURDEN NOT INCLUDING SELLING EXPENSE
INDIRECT LABOR
ALL MISC. EXP & SUPPLIES
FIXED CHARGES
MANUFACTURING EXPENSE LEDGER ACCT ANALYSED TO THE — DEPARTMENTS.
DEPARTMENTS. NAMES AND NUMBERS.
STEAM
POWER & LIGHT
TOOL AND MAINTENANCE
PATTERN SHOP
GENERAL OFFICE
GENERAL FACTORY
GENERAL FOUNDRY
MELTING
CORE ROOM
MOULDING
CLEANING
ANNEALING
MACHINE SHOP
PACKING & SHIPPING
GOODS FINISHED & IN PROCESS LEDGER ACCT
SELLING EXPENSE LEDGER ACCT
FINAL COST COST OF GOODS SOLD + SELLING EXPENSE
ASSETS.— NEW BUILDINGS, EQUIPMENT, ETC. NEW PATTERNS, TOOLS, ETC.
No. CONTRIBUTORY DEPARTMENTS
No. PRODUCTIVE DEPARTMENTS
CONTRIBUTORY DEPARTMENT EXPENSES ARE
DISTRIBUTED TO
THE VARIATION IN THESE SHADED SECTIONS REPRESENTS THE PROPORTION OF THE DISTRIBUTED EXPENSE WITH WHICH EACH DEPARTMENT HAS BEEN CHARGED
DEPARTMENTAL TOTAL EXPENSES
THESE SHADED SECTIONS REPRESENT THE PROPORTION OF DEPARTMENTAL EXPENSE TO THE TOTAL EXPENSE
DEPT NO. 10 $2700.00
" NO. 11 900.00 1/3
" NO. 9 900.00 1/3
AND SO ON.
IE SHADED AREA OF DEPT NO. 11 IS 1/3 THE SHADED AREA OF DEPT NO. 10.
SELLING EXPENSE
DIRECT ORDERS
THE SUM = MANUFACTURING COST.
THE SUM = TOTAL SELLING EXPENSE
THE SUM = THE TOTAL COST OF GOODS SOLD WHEN ALL PRODUCTION IS SOLD
COST COLLECTION.
ACCUMULATED MANUFACTURING COST
EXPENSE
EXPENSE INCREASED BY DIRECT AMOUNTS
DIRECT LABOR
LABOR INCREASED BY DIRECT AMOUNTS
MATERIAL
MATERIAL STARTS WITH MELTING (IRON) INCREASED IN MACHINE SHOP

FORM 54.

This item completes the list of amounts to be journalized, with the exception of the Abnormal Expense. The amount

of this expense is also shown with the other entries, but the description of its development will be given in the chapter on Abnormal Expense.



Journal Entries

Month of

31	Goods Fin. & in Process		✓	6740 00	
		Pig & Scrap	✓		6000 00
		Miscel. Stores	✓		740 00
	Direct Materials For The Month				
31	Pig & Scrap		✓	500 00	
		Goods Fin. & in Process	✓		500 00
	Return Scrap For The Month				
31	Manufacturing Expense		✓	2581 00	
		Miscel. Stores	✓		1360 00
		Fuel	✓		365 00
		Packing Materials	✓		110 00
		Coke	✓		300 00
		Sand	✓		170 00
		Pattern Lumber	✓		160 00
		Annealing Materials	✓		116 00
	Expense Materials For The Month				
31	Goods Fin. & in Process		✓	7550 00	
	Manufacturing Expense		✓	6406 00	
		Pay Roll	✓		13956 00
	Pay Roll For The Month				
31	Manufacturing Expense		✓	196 00	
		Insurance	✓		50 00
		Taxes	✓		30 00
		Reserve For Depreciat'n	✓		116 00
	Fixed Charges For The Month				
31	New Equipment		✓	131 00	
	Tools Jigs & Fixtures		✓	65 61	
		Manufacturing Expense	✓		196 84
	Asset Charges From Tool & Maintenance Dept				
31	New Pattern Equipment		✓	373 23	
	" Equipment		✓	169 12	
		Manufacturing Expense	✓		542 35
	Asset Charges From Pattern Dept.				
31	Goods Fin. & in Process		✓	238 82	
		Manufacturing Expense	✓		238 82
	Direct Orders From Pattern Dept.				
31	Selling Expense		✓	363 51	
		Manufacturing Expense	✓		363 51
	Share of Office to Selling Expense				
31	Selling Expense		✓	508 39	
		Manufacturing Expense	✓		508 39
	Packing & Shipping Expense to Selling				
31	Abnormal Profit & Loss		✓	521 09	
		Goods Fin. & in Process	✓		521 09
	Abnormal Loss For The Month				
31	Goods Fin. & in Process		✓	7783 09	
		Manufacturing Expense	✓		7783 09
	Net Manufacturing Expense For The Month				
31	Cost of Goods Sold		✓	20000 00	
		Goods Fin. & in Process	✓		20000 00
	Cost of Sales For The Month				
				54527 09	54527 09

FORM 55.

127. The Journal Entries Needed.—The complete list of Journal entries for this month's transactions is shown on the Monthly Journal, Form 55, and includes all the entries that are necessary for the final closing of the books.

Too frequently there will be found an almost endless list of journal entries which adds tremendously to the labor of bookkeeping and the possibilities of errors. This work is greatly reduced by the expense analysis which gives a control of the operating expenses of the business, otherwise impossible when postings are made to a long list of ledger accounts.

Reference to the chart of accounts, Form 2, will show how all entries have been made in accord with the description in the preceding paragraphs and the journal entries, Form 54.

These amounts are the same as have been used in the expense analysis for distribution, and the determination of the unit costs, thus showing the tie-in with the general books.

128. A Graphic Cost Chart.—The entire construction of manufacturing and final costs is graphically shown on the analysis chart, Form 54. At the top of the chart the source of all expenses is illustrated in the form of indirect labor, all miscellaneous expenses and supplies, and fixed charges, with arrows indicating the debits to the Manufacturing Expense Account. The expense items, of which this account is the ledger control, are indicated as being distributed to the departments. This graphic distribution corresponds to the detailed description of the analysis which has been presented in all the preceding chapters.

On the center section of the chart shaded areas are shown opposite the departments in the space at the left. These areas are proportioned to the total expense of the contributory departments as explained on the chart.

Attention is called to the graduated absorption of the expense of the contributory departments into the productive departments as represented by the heavy diagonal line from Department 1 to Department 8.

The shaded areas opposite the productive departments are proportioned to the total expense, as the chart illustrates, while the accumulated cost is represented below. These graduated areas are proportioned to the amounts of the total expense and labor cost as accumulated.

Metal is shown as the same amount through all the departments because the value of the metal in the casting remains the same. The only increase in the material cost is shown in the machine shop where a small amount of material is added in assembling.

The total manufacturing cost, selling expense and final cost is represented in the column to the right, together with the amounts charged to assets.

The notations on the chart describe these details and the chart serves graphically to picture the entire description of costs which has been outlined in the preceding chapters.

CHAPTER XIII

NORMAL AND ABNORMAL COSTS

Although foundries are equipped for 100 per cent production, it is rarely that they operate at capacity year in and year out. Dull business will make orders fall to a point where a partial shut-down is necessary; again, prosperity may cause a great deal of overtime to be put in.

Suppose a foundry making a single product has the capacity to turn out 10,000 castings a month with a normal expense of $10,000, or at the rate of $1 per unit produced.

129. How Idleness Affects Costs.—During a period of depression, orders fall off and the foundry is forced to operate at only 50 per cent capacity. Naturally, strenuous efforts will be made to reduce the overhead expense so that it will be, as nearly as possible, in proportion to the production. But there are some items of overhead such as fixed charges, the salaries of executives, and protection through heat, light and watching, which cannot readily be reduced in proportion to the falling off in production. However, it may be found possible to reduce the overhead to $7,500 with the 50 per cent production, making the overhead $1.50 per unit instead of the normal cost for 10,000 units of $1 per unit.

That is why, when production falls off, the actual cost of the product increases. If prices could be raised, the increased cost would be met; but as everyone knows, it is just at such times that prices emphatically cannot be raised. In fact, the sales department will soon protest that to get orders at all, the prices must be cut.

130. Actual Costs Always Fluctuate.—Even during times of normal activity, the production will fluctuate enough to cause the operating expense per unit of production to vary continually. It will be high one month and low another.

And the overhead expense per unit of production is affected also by fluctuations in the total amount of overhead expense, from month to month.

The effect of both of these fluctuations may result like this:

1. Normal activity:
    10,000 units at $10,000 = $1 per unit.
2. Increased activity:
    10,500 units at $10,100 = $0.962 per unit.
3. Decreased activity:
    9,500 units at $10,050 = $1.059 per unit.

In case 2, a 5 per cent increase in the production with only 1 per cent increase in the total expense gives a lower unit cost. In case 3, a decrease in production with a slight increase in expense gives a slight increase in the unit cost.

Such variations as these are not excessive with normal activity. They can be controlled to some extent, but not entirely eliminated.

131. The Danger in Actual Costs.—The foundryman may well wonder how he is to cost his product, since there is apt to be a different unit cost every month and he may not sell this month's product for two or three months to come, when his cost likely enough will then be different. The temptation is to set prices on the basis of actual costs, which will inevitably lead to serious errors and often actual losses.

The solution lies in the use of normal and abnormal costs, a development of great value in cost finding.

First, it provides a normal or standard cost which is the cost of the product when the foundry is operating at normal capacity; and which is always used to cost out the product sold. The fluctuations from week to week and month to month show gains or losses which are considered as gains or losses to the business. They are not taken as part of the cost of production.

Second, in dull times, it enables the management intelligently to attract new business on a price basis which will result in reducing the cost of the product to a point at which profits will result. All foundrymen do this now, but they do it blindly, *hoping* rather than *knowing* that they will get a profit.

Third, it prevents penalizing the foundry by forcing a burden upon it when production is low, not by its own fault, but because of fluctuating business conditions or poor sales policies. The shop should not be held responsible for increased operating costs when such increases are due to conditions over which it has no control.

Fourth, the normal method makes it possible to study the actual expenses in comparison with the standard, not only for the plant as a whole, but in each department. If a budget be used, this comparison may be made in detail by items of expense. This enables the executives to exercise close control by watching and curtailing excess expenditures. It shows not only that a department is being operated at high cost, but which items of expense cause this high cost.

132. Using Normal Cost Figures.—Two foundries, identical in every respect and both making the same product, are operated under one management. Suppose that the expense rate is the same in both shops. If production falls off 50 per cent, so that it becomes necessary to close one of the shops, it is not correct to add the unearned expense of the idle shop to the expense of the shop which continues to produce. That would raise the apparent costs of the active shop to a fictitious figure which, if reflected in the selling price, would soon divert business to competitors and the second shop would soon close.

With one shop closed, it costs no more to produce in the second shop. The cost actually remains the same and should so appear. The expense which becomes unearned by closing one shop is a business loss and should be carried on the general books.

The same principle applies to idle machines in a department. Every idle machine hour produces a business loss which should not be carried as a part of the cost of production.

133. An Example of Normal Costing.—The foundry executive may naturally inquire how these losses or gains should be accounted for. Here is an illustration:

First: Low production—abnormal loss.

	Normal	Actual
Total expense	$10,000.00	$7,800.00
Units produced	10,000	6,000
Cost per unit	$1.00	$1.30

With the normal unit cost at $1, the actual expense, with a production of 6,000 units, should be $6,000, but it amounts to $7,800, or $1,800 more than the normal ratio. There is therefore an unearned expense amounting to $1,800 which remains in the Goods in Process Account because the cost of the goods sold has been credited to the account at normal. The $1,800 is a business loss and must be credited to the Goods in Process Account and charged to the Abnormal Profit and Loss Account. The journal entries will be:

	Dr.	Cr.
Abnormal profit and loss	$1,800	
Goods finished and in process		$1,800

Second: High production—abnormal gain.

Total expense	$10,000.00	$10,200.00
Units produced	10,000	12,000
Cost per unit	$1.00	$0.85

134. Adjusting the Books.—With a normal unit cost of $1, the actual expense with a production of 12,000 units, should be $12,000, but it amounts to only $10,200 or $1,800 less than the normal ratio calls for. Since the cost of the goods sold has been figured at normal, this means that $1,800 too much has been credited to the Goods in Process Account. The fact is that the actual expenses which were charged to the Goods in Process Account were $1,800 less than normal. Therefore, the adjustment becomes a debit to the Goods in Process Account and a credit to the Abnormal Profit and Loss Account.

The journal entries for this item will be:

	Dr.	Cr.
Goods finished and in process	$1,800	
Abnormal profit and loss		$1,800

When operating conditions are reasonably near normal, the gains and losses may be comparatively small and the balance in the Abnormal Profit and Loss Account at the end of the year or period may show a rather small amount.

Let us now see how these normal expenses are determined.

135. Arriving at Normal Figures.—In practice, the 100 per cent capacity of a foundry is not taken as the normal operating condition. This is because there are seldom enough orders to fill the shop; because a constant flow of product is seldom maintained; because machines will break down, employes will lay off and accidents or fires will occur. Taking these things into consideration it is found that 80 per cent of the full theoretical capacity is about the normal operating activity of most foundries. That is what we shall assume as normal in this discussion.

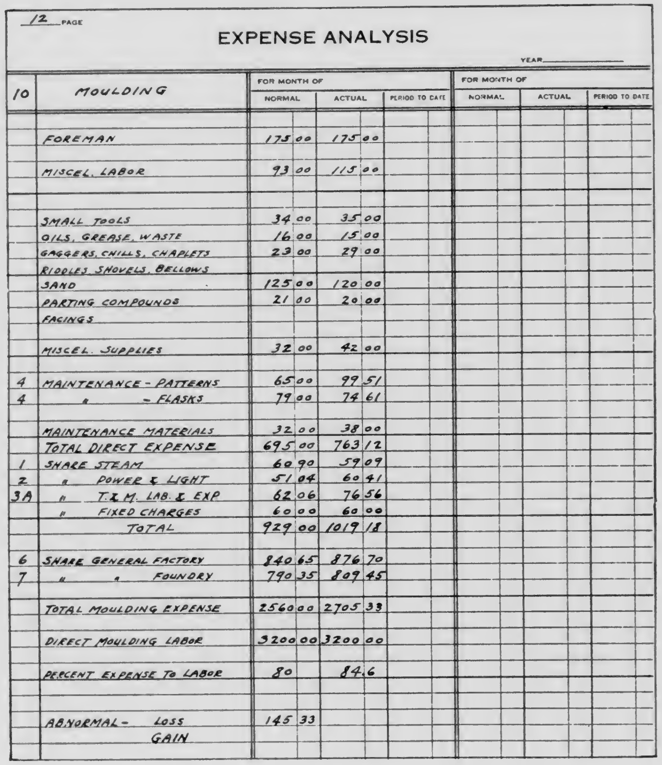
Thus, if a plant or a department operates on a 9-hour day and then finds it necessary to run 3 hours overtime, its operating capacity is considered as 133⅓ per cent of the day shift. Its normal activity then is 80 per cent of 133⅓ or 106.6 per cent.

The conditions in each department of a foundry must be thoroughly analyzed before the normals are set, and then it becomes necessary to consider each item of expense in each department in order to determine its amount and its proportion to the normal total. This determination should be based on actual performance for a period of normal production. If this record is not to be found, the setting of normals is nevertheless possible.

The expense analysis may be operated for a period of three or four months to develop the actual expenses; and the normal amounts for each item set in association with the record.

136. Normal Moulding Costs.—For instance, let us describe how the normals would be set for the Moulding Department, whose expense analysis and normals are shown on Form 56.

The first item is the foreman's salary, which goes on whether the department is operated full or part time. The actual amount is therefore considered as a normal expense.



12 PAGE

EXPENSE ANALYSIS

YEAR

10	MOULDING	FOR MONTH OF NORMAL	ACTUAL	PERIOD TO DATE	FOR MONTH OF NORMAL	ACTUAL	PERIOD TO DATE
	FOREMAN	175 00	175 00				
	MISCEL. LABOR	93 00	115 00				
	SMALL TOOLS	34 00	35 00				
	OILS, GREASE, WASTE	16 00	15 00				
	GAGGERS, CHILLS, CHAPLETS	23 00	29 00				
	RIDDLES SHOVELS, BELLOWS						
	SAND	125 00	120 00				
	PARTING COMPOUNDS	21 00	20 00				
	FACINGS						
	MISCEL. SUPPLIES	32 00	42 00				
4	MAINTENANCE - PATTERNS	65 00	99 51				
4	" - FLASKS	79 00	74 61				
	MAINTENANCE MATERIALS	32 00	38 00				
	TOTAL DIRECT EXPENSE	695 00	763 12				
1	SHARE STEAM	60 90	59 09				
2	" POWER & LIGHT	51 04	60 41				
3A	" T. & M. LAB. & EXP	62 06	76 56				
	" FIXED CHARGES	60 00	60 00				
	TOTAL	929 00	1019 18				
6	SHARE GENERAL FACTORY	840 65	876 70				
7	" " FOUNDRY	790 35	809 45				
	TOTAL MOULDING EXPENSE	2560 00	2705 33				
	DIRECT MOULDING LABOR	3200 00	3200 00				
	PERCENT EXPENSE TO LABOR	80	84.6				
	ABNORMAL - LOSS	145 33					
	GAIN						

FORM 56.

The next item, miscellaneous labor, is controllable, and the normal allowance for this labor is set at $93. The expenses for the department appear to be high with a normal production as compared with the direct labor. It therefore indicates that an excess amount of miscellaneous labor has been used. This might be worth study by the foreman.

The items of small tools and oils, grease and the other items for supplies have been set in proportion to the production.

The upkeep of patterns and flasks will depend upon the class of product being made and the amount of handling which this equipment may require. With a standard product the determination of this expense is comparatively simple, but with jobbing work and a variation in the quantities ordered the problem becomes more complex.

Often the ratio of these items to the tons poured may prove a very satisfactory basis for determining the amounts. This basis, however, must be considered with care as conditions of work will largely govern.

The use of steam will fluctuate to some extent with the seasons and a varying charge will result. The chargeable amounts however, may be normalized so as to give an equitable monthly distribution.

Power will fluctuate with production; but lights will also be affected by careful or careless use. The normal amounts for distribution however, must be determined in the department of Power and Light and then posted to the departments served. Fixed charges do not fluctuate with production; therefore the normal and actual will be the same.

137. Other Departments.—The amounts set up for shares of General Factory and General Foundry have been determined in their respective departments and brought forward. The difference between the actual and normal on these items seem more marked than on the other items, part of which may be due to larger differences in operating expenses in the other departments.

When the normal expenses have been set up for the contributory departments, they are distributed to the productive departments in exactly the same way as the actual expenses.

The normal expenses for the other productive departments are set in the same way as for the Moulding Department.

In some instances the normal unit cost is based on pounds, in others it is based on units or the percentage of expense to labor. These bases will vary, depending upon the department for which the determination is made.

In the moulding department the basis used is the productive labor dollar. The normal expenses have been totaled and measured against what has been considered a normal amount for direct moulding labor. The normal expense rate, therefore, proves to be 80 per cent of expense to labor. The actual expenses for the month are higher, with the same amount of direct labor, which gives an actual rate of 84.6 per cent.

138. Losses and Gains.—To determine the abnormal loss or gain for the department, the actual direct labor is used and the normal rate applied in order to arrive at the amount of expense which should exist with the normal ratio.

The calculation is:

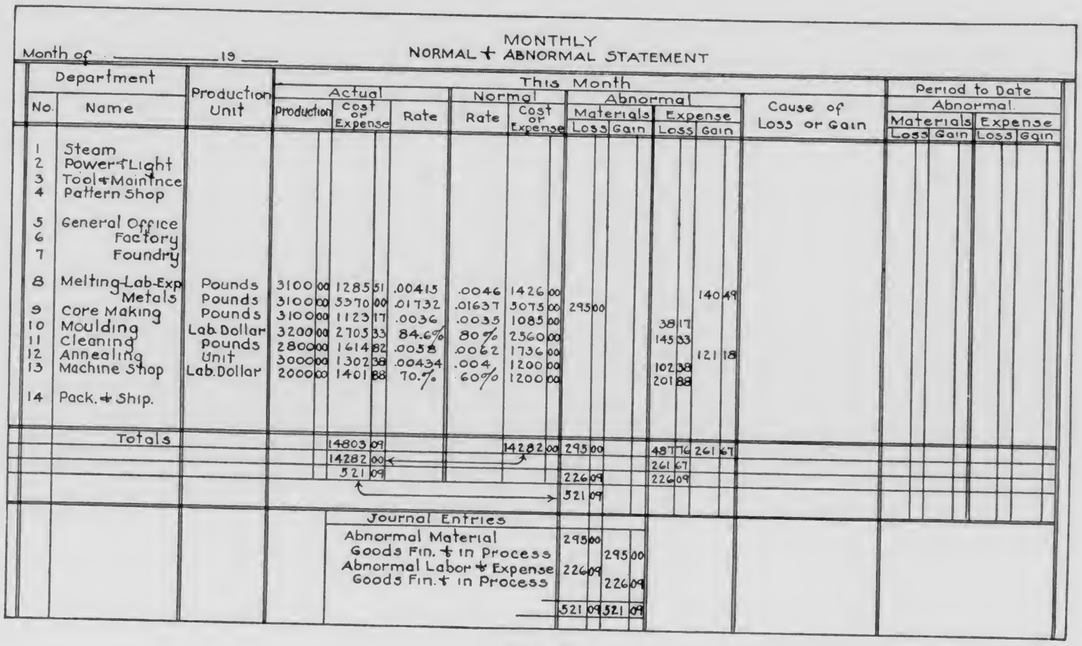
Actual direct labor....................	$3,200	
Actual expense.......................		$2,705.33
Actual rate..........................	80 per cent	
Normal expense—80 per cent of $3,200..		2,560.00
Abnormal loss.....................		$ 145.33

The gain and loss for the other departments are determined in the same way and then collected so that the net gain or loss for the plant may be obtained.

The difference between the actual and normal expenses makes up the business gains and losses which must be taken care of through the accounts.

The method just described provides for debiting the actual expenses to the Goods Finished and In Process Account, while the credits to this account are made on a normal cost basis. The adjustments due to the abnormal gains or losess are therefore made to this account with debits or credits to the Abnormal Profit or Loss Account.

Another method is to normalize the expense so that the debits to the Goods Finished and In Process Account will be on a normal basis, in which case the adjustments due to



Month of ________ 19 ____

MONTHLY
NORMAL & ABNORMAL STATEMENT

Department No.	Department Name	Production Unit	This Month Actual Production	This Month Actual Cost or Expense	This Month Actual Rate	This Month Normal Rate	This Month Normal Cost or Expense	This Month Abnormal Materials Loss	This Month Abnormal Materials Gain	This Month Abnormal Expense Loss	This Month Abnormal Expense Gain	Cause of Loss or Gain	Period to Date Abnormal Materials Loss	Period to Date Abnormal Materials Gain	Period to Date Abnormal Expense Loss	Period to Date Abnormal Expense Gain
1	Steam															
2	Power & Light															
3	Tool & Maintnce															
4	Pattern Shop															
5	General Office															
6	Factory															
7	Foundry															
8	Melting-Lab-Exp	Pounds	3100.00	1285.51	.00415	.0046	1426.00				140.49					
	Metals	Pounds	3100.00	5370.00	.01732	.01637	5075.00	295.00								
9	Core Making	Pounds	3100.00	1123.17	.0036	.0035	1085.00			38.17						
10	Moulding	Lab. Dollar	3200.00	2705.33	84.6%	80%	2560.00			145.33						
11	Cleaning	pounds	2800.00	1614.82	.0058	.0062	1736.00				121.18					
12	Annealing	Unit	3000.00	1302.38	.00434	.004	1200.00			102.38						
13	Machine Shop	Lab. Dollar	2000.00	1401.88	70.%	60%	1200.00			201.88						
14	Pack. & Ship.															
	Totals			14803.09			14282.00	295.00		487.76	261.67					
				14282.00						261.67						
				521.09				226.09		226.09						
								521.09								

Journal Entries

Abnormal Material	295.00	
Goods Fin. & in Process		295.00
Abnormal Labor & Expense	226.09	
Goods Fin. & in Process		226.09
	521.09	521.09

FORM 57.

abnormal gains or losses would be made through the Manufacturing Expense Account. This method will keep the Goods Finished and In Process Account on a normal basis and leave no discrepancies in the account when credits are made when cost of sales are figured at normal. There is little difference in the two methods, although the first is preferred because it is simpler to operate.

139. Analyzing the Losses and Gains.—On the chart of accounts, Form 2, only one Abnormal Profit and Loss Account is shown. In some instances, it will be desirable to separate this account into three, namely, Material, Labor and Expense. This is rarely necessary because these details may be carried on the abnormal statement for the month and the one account in the ledger may serve as the control.

With the closing of the expense analysis for the month, a statement of the abnormal gains and losses is made up on Form 57. The departments are listed with the actual and normal performances. Opposite each department the reason for the gains or losses is given. All of these items are shown as of "this month," with a set of columns to the right for "period to date."

At the bottom, the totals are entered and the net gain or loss for the month and period determined. The actual gains and losses by departments prove with the difference between the normal and actual expenses. The journal entries required are also shown.

This statement shows the executive at a glance which departments have fallen short of, or exceeded, the normal expense rate. While it shows only the totals, a reference to the expense analysis will show the items of expense which have caused these differences. Action can then be intelligently taken.

The normal method of handling costs standardizes the cost of the product and aids in accurately controlling the inventories, which is an item of great importance.

140. Inventory Control.—To illustrate the inventory control, let us assume the normal cost of a casting to be

$40. Business decreases so that the expense increases the cost to $44. The selling price is $42. It was no fault of the foundry that business decreased and orders fell off, therefore the cost should still be considered $40, the increase of $4 in the cost being carried as a business or abnormal loss.

Suppose this casting was inventoried at its actual cost, $44. The sale price is only $42 and the casting cannot be worth more than it will bring. Consequently, if the inventory carries a figure of $44, the statement at the end of the period will be inflated by the Goods in Process Inventory to such an extent that what was actually a loss will show as an apparent profit. Many concerns have gone to the wall because they inventoried on this basis.

141. A Statement.—The normal cost is the only safe method on which to base manufacturing control. It not only shows the actual gains and losses with business fluctuations but serves as a guide and check on operating conditions. Let us assume that the productive departments show the following abnormal figures:

	Gain	Loss	Explanation
Department 8..........	$100	......	Increased production
Department 9..........	....	$ 300	Heavy repairs
Department 10..........	....	800	Heavy losses
Department 11..........	200	......	Decreased N. P. labor
Department 12..........	....	300	Heavy breakage
Department 13..........	....	400	Low production
	$300	$1,800	

Net loss due to abnormal expenses, $1,500.

Such a report from the cost department would lead the management at once to place the responsibility where it belonged. The cause of the loss is made clear and an effort to correct the conditions can be undertaken immediately. The executive can, if he will, use the figures given by his cost system to effect many economies in operation.

142. Intimate Knowledge of Conditions.—It is only through a well designed cost accounting system that profits can be accurately known. It is not enough to know merely the gross profits; the profit on each order or class of castings should be definitely known. This may seem obvious, but the fact remains that many concerns which think they know profits have only a most sketchy and often inaccurate idea of what profits they make and why they make them.

It is not enough that the cost figures alarm the executive. They must show him how and why and where profits and losses are made, and so guide him to those places in his business where betterments should be made. The development of the following account from lump sum to details shows how an executive may or may not locate the profit items.

The profit or loss statement of a concern was as follows:

Sales.............................		$50,000
Manufacturing cost.................	$45,000	
Selling expense....................	3,500	
Net profit.........................	1,500	
	$50,000	$50,000

Such a statement shows an unsatisfactory condition and yet it offers no clew to the cause.

Suppose that the concern makes three classes of castings. The foundryman could have a statement drawn up similar to the following one which shows the profit and loss on each class:

	Class A	Class B	Class C	Total
Sales........................	$25,000	$15,000	$10,000	$50,000
Manufacturing cost...........	24,000	12,500	8,500	45,000
Selling expense..............	1,750	1,050	700	3,500
Profit.......................	....	$ 1,450	$ 800	$ 1,500
Loss.........................	$ 750			

143. How Costs Control Operations.—This statement obviously shows that Classes B and C are manufactured at a profit, while Class A shows a loss. But even this statement would not give the real reasons for the trouble that might well be attributed to any one of a number of things. For instance, a quite obvious deduction would be that the business would be more profitable if Class A were discontinued. The following method of making the statement enables him to get closer to the causes of weakness:

	Class A	Class B	Class C	Total
Sales	$25,000	$15,000	$10,000	$50,000
Manufacturing cost	23,500	11,750	8,250	43,500
Selling expense	1,750	1,050	700	3,500
Profit	......	$ 2,200	$ 1,050	$ 3,000
Loss	$ 250			
Loss due to abnormal expense	....	......	....	1,500
Net profit	....	....	....	$ 1,500

To get the very best results, however, he will demand that the report be made by departments as well, which will show him that the cause of the trouble was in the departments 9, 10, 12 and 13.

	Gain	Loss	Explanation
Department 8	$100	......	Increased production
Department 9	....	$ 300	Heavy repairs
Department 10	....	800	Heavy losses
Department 11	200	......	Decreased non-productive labor
Department 12	....	300	Heavy breakage
Department 13	....	400	Low production
	$300	$1,800	

Net loss due to abnormal expense $1,500.

144. An Actual Experience.—Here is a striking actual example of how properly devised normal cost statement reflected a serious mistake in management so vividly that the wrong methods were quickly changed.

The superintendent of a company conceived the idea that he could greatly economize in the foundry by laying off some of the old-time moulders, who were, in his judgment, too slow, and replacing them with "live wires" at a somewhat reduced rate. After a lengthy and rather pointed discussion, the superintendent was allowed to try the experiment.

The results were as follows, the experiment being started during the second month of the period represented:

Tabulated Results from the Expense Analysis

	First month	Second month	Third month	Fourth month	Normal	Three months' total
5. *General Factory:*						
Total expense	$7,945.30	$8,544.14	$11,163.34	$8,399.80	....	$28,207.28
Total direct labor	13,477.24	13,085.34	9,474.24	11,754.57	....	34,314.15
Per cent expense to labor	58.8	65.3	118	72.3	....	82
6. *Melting:*						
Metal labor and expense	2,078.94	1,916.94	566.97	1,060.76	....	3,544.61
Castings produced, pounds	97,238.00	86,840.00	12,883.00	38,204.00	....	137,921.00
Cost per pound	0.0214	0.0221	0.047	0.0277	0.0215	0.0256
				Abnormal loss.....		579.24
7. *Core Room:*						
Total core cost	674.29	632.36	159.28	417.74	....	1,209.38
Castings produced, pounds	97,238.00	86,840.00	12,883.00	38,204.00	....	137,927.00
Cost per pound	0.007	0.0073	0.0125	0.0108	0.007	0.0087
				Abnormal loss.....		9.42
8. *Moulding;*						
Total moulding expense	4,050.20	3,935.96	1,840.02	2,700.61	....	8,476.59
Castings produced, pounds	97,238.00	86,840.00	12,883.00	38,204.00	....	137,927.00
Cost per pound	0.0416	0.0453	0.142	0.0705	0.04	0.061
				Abnormal loss.....		2959.51
9. *Cleaning:*						
Total cleaning cost	419.66	533.44	313.75	259.19	....	1,106.28
Castings produced, pounds	97,238.00	86,840.00	12,883.00	38,204.00	....	137,927.00
Cost per pound	0.0043	0.0062	0.0242	0.0064	0.004	0.008
				Abnormal loss.....		553.19
10. *Machine Shop:*						
Total expense	2,940.03	2,896.05	4,418.49	4,982.07	....	12,296.61
Total direct labor	2,288.38	2,639.63	2,332.88	3,695.68	....	8,668.19
Per cent expense to labor	128	111	189	135	120	142
				Abnormal loss.....		1,895.00

Tabulated Results from the Expense Analysis—*Continued*

	First month	Second month	Third month	Fourth month	Normal	Three months' total
11. *Forge Shop:*						
Total expense	228.37	230.63	298.68	255.18	....	784.49
Total direct labor	204.24	217.43	136.58	260.64	....	614.65
Per cent expense to labor	112	106	218	98	100	128
				Abnormal	loss.....	169.84
12. *Wood Mill:*						
Total expense	1,283.20	1,001.97	1,688.79	1,353.43	....	4,044.19
Total direct labor	1,077.55	703.17	968.00	1,136.18	....	2,807.35
Per cent expense to labor	119	142	175	120	120	144
				Abnormal	loss.....	675.79
13. *Assembly Dept:*						
Total expense	1,916.56	1,686.29	2,840.79	2,740.55	....	7,267.63
Total direct labor	1,717.71	1,620.51	2,008.68	2,821.79	....	2,450.98
Per cent expense to labor	112	104	142	97	100	112
				Abnormal	loss.....	816.65
14. *Selling Expense:*						
Total expense	9,600.00	8,500.00	8,000.00	8,250.00	....	34,350.00
Total net sales	86,000.00	85,000.00	33,000.00	38,000.00	....	222,000.00
Per cent expense to total	10	19	24.2	21.7	12.5	16.2
				Abnormal	loss.....	6,650.00
	Loss in profits because unable to make shipments and keep up the sales					4,300.00

The following analysis sums up the condition of operation from the above tabulation:

	Gain	Loss
Department 6	......	$ 579.24
Department 7	......	9.42
Department 8	......	2,959.51
Department 9	......	553.19
Department 10	......	1,895.00
Department 11	......	169.84
Department 12	......	675.79
Department 13	......	816.65
		$7,658.64

Net loss due to abnormal expense in manufacturing	$ 7,658.64
Shipments were forced to drop with only a small reduction in the expense which increased the normal by	6,650.00
In addition to this the loss in profits which should have been realized on normal shipments	4,300.00
Total loss due to these abnormal conditions	$18,608.64

If the management had not been able to spot the losses so quickly—in the second month of the experiment—the mistake in judgment might have been allowed to go on for several disastrous months or even years. The whole expense of installing the cost system was saved many times over, merely by stopping this loss so quickly.

145. Getting Business in Dull Times.—Now let us see how normal costs help a business to get much needed business when the bottom seems to have dropped out of things. The case described is an actual one, with fictitious round figures substituted for convenience sake.

This foundry was forced to operate much below its normal capacity so that losses were accumulating rapidly. The normal cost of a unit of product was $20, with a selling price of $22. The management was not inclined to reduce prices because material and labor costs were still high, yet it could secure but a few orders.

As we have seen, certain items of expense fluctuate with production, while others go on whether the plant is busy or idle.

The management of this foundry widely installed a good cost system at just this critical time, which enabled them to analyze the cost of their product like this:

Material	$ 6
Labor	7
Expense	7
	$20

A further analysis showed that the $7 expense was composed of $5 fixed expense due to idleness and $2 direct productive expense. Considering, then, only the direct expenses they determined a new cost which might be termed the "minimum cost."

This cost was made up of:

Material	$ 6
Labor	7
Expense	2
	$15

There is therefore a margin of $5 between the minimum and the normal cost. These costs provide limits between which prices may be adjusted with safety in order to attract business and reduce losses.

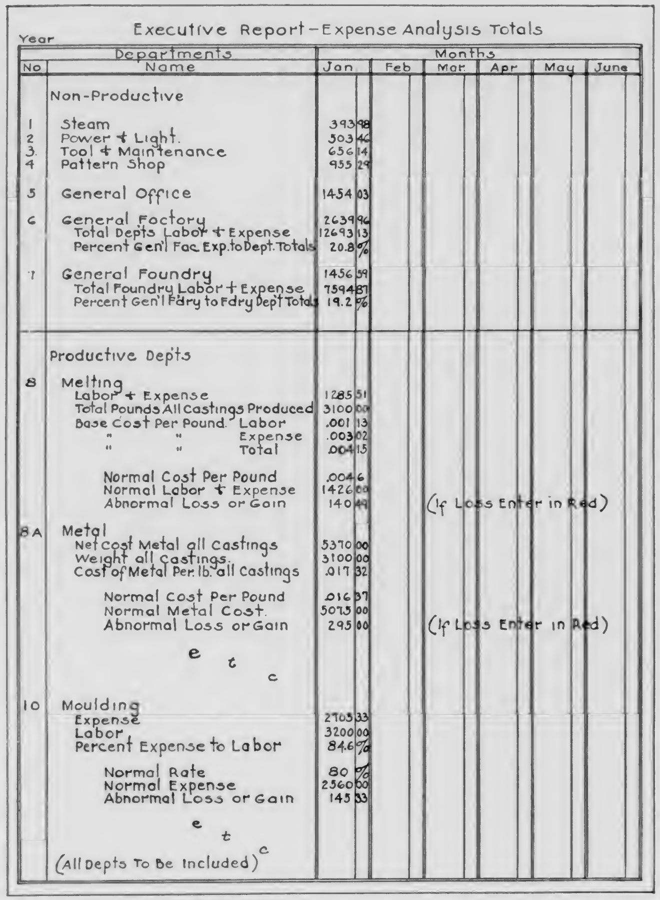
146. Reducing Losses Intelligently.—It must be clearly borne in mind, however, that the minimum cost is not a basis for setting selling prices. But all that can be secured in price above the minimum will help to get back at least part of the fixed expenses which would otherwise be a dead loss. When business cannot be secured at the normal price it is better business to reduce the price 10 or 15 per cent, secure more orders, increase the production and reduce the losses. That is what this foundry did, to such good purpose that its losses were at once cut in half.

The absence of this basis of business control has been the cause of many failures during every business depression. The president of one large company for which we developed a complete expense analysis with normal and minimum costs remarked, "If we had had that method in use in 1920, we could have reduced our losses a quarter of a million dollars. We lost thousands of orders because we were 5 or 10 per cent high, simply because we thought we had to stick to what we called our standard price."

147. A Departmental Report.—It is frequently advisable to show the standing of the departments by monthly comparison. For this purpose a report similar to that shown in Form 58, may well be used.

When such a report shows a fluctuation, the executive should know at once the cause. For this purpose, a departmental report similar to that shown as Form 59 may be used.

The effectiveness of the departmental report may be increased by showing it to the foreman two or three days in advance of a monthly meeting. There these problems may be discussed and plans laid for bettering operating conditions. Form 59 embodies an additional feature in that it shows the ratio of each expense item to the direct labor. Mere figures will not tell the true story of expense fluctuations. It is the ratio or proportion to production which must be known. Many expense items may show marked increases for the month and a question may be raised as to why this should be. If the ratio of these

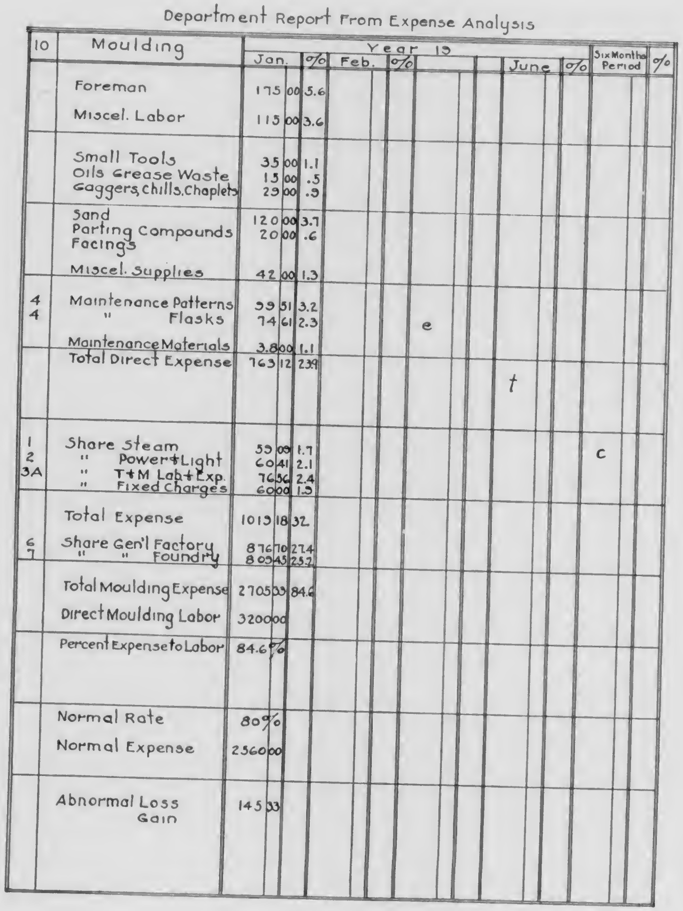


Executive Report—Expense Analysis Totals

Year

Departments		Months					
No	Name	Jan	Feb	Mar	Apr	May	June
	Non-Productive						
1	Steam	393 98					
2	Power + Light.	503 46					
3.	Tool + Maintenance	656 14					
4	Pattern Shop	955 29					
5	General Office	1454 03					
6	General Factory	2639 96					
	Total Depts Labor + Expense	12693 13					
	Percent Gen'l Fac. Exp. to Dept. Totals	20.8 %					
7	General Foundry	1456 59					
	Total Foundry Labor + Expense	7594 87					
	Percent Gen'l Fdry to Fdry Dep't Totals	19.2 %					
	Productive Dep'ts						
8	Melting						
	Labor + Expense	1285 51					
	Total Pounds All Castings Produced	3100 00					
	Base Cost Per Pound. Labor	.001 13					
	" " Expense	.003 02					
	" " Total	.004 15					
	Normal Cost Per Pound	.004 6					
	Normal Labor + Expense	1426 00					
	Abnormal Loss or Gain	140 49		(If Loss Enter in Red)			
8A	Metal						
	Net cost Metal all castings	5370 00					
	Weight all castings.	3100 00					
	Cost of Metal Per. lb. all castings	.017 32					
	Normal Cost Per Pound	.016 37					
	Normal Metal Cost.	5075 00					
	Abnormal Loss or Gain	295 00		(If Loss Enter in Red)			
	e t c						
10	Moulding						
	Expense	2705 33					
	Labor	3200 00					
	Percent Expense to Labor	84.6 %					
	Normal Rate	80 %					
	Normal Expense	2560 00					
	Abnormal Loss or Gain	145 33					
	e t c						
	(All Depts To Be Included)						

FORM 58.



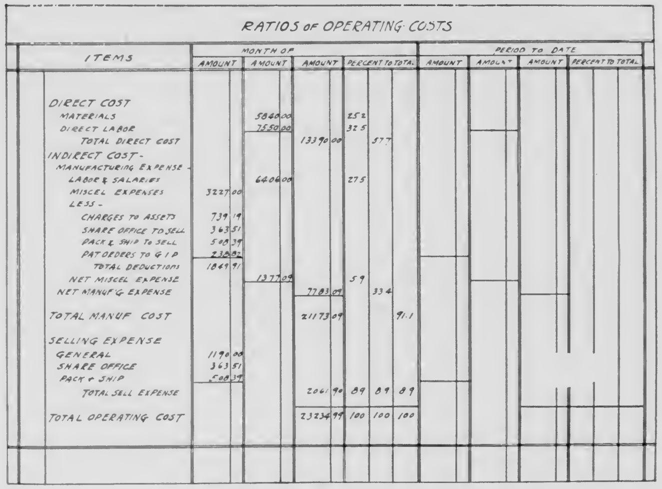
Department Report From Expense Analysis

10	Moulding	Year 19 Jan.	%	Feb.	%		June	%	Six Months Period	%
	Foreman	175 00	5.6							
	Miscel. Labor	115 00	3.6							
	Small Tools	35 00	1.1							
	Oils Grease Waste	15 00	.5							
	Gaggers, Chills, Chaplets	29 00	.9							
	Sand	120 00	3.7							
	Parting Compounds	20 00	.6							
	Facings									
	Miscel. Supplies	42 00	1.3							
4	Maintenance Patterns	99 51	3.2							
4	" Flasks	74 61	2.3			e				
	Maintenance Materials	3.8 00	1.1							
	Total Direct Expense	763 12	23.9				t			
1	Share Steam	59 09	1.7						c	
2	" Power & Light	60 41	2.1							
3A	" T & M Lab & Exp.	76 56	2.4							
	" Fixed Charges	60 00	1.9							
	Total Expense	1019 18	32.							
6	Share Gen'l Factory	876 70	27.4							
7	" " Foundry	809 45	25.2							
	Total Moulding Expense	2705 33	84.6							
	Direct Moulding Labor	3200 00								
	Percent Expense to Labor	84.6%								
	Normal Rate	80%								
	Normal Expense	2560 00								
	Abnormal Loss	145 33								
	Gain									

Form 59.

increases to the direct labor or unit of production is shown, these increases may turn out to be really reductions.

Another report of value is the Ratio of Operating Costs, Form 60. This gives the ratios of all operating cost items to the total cost for the current month and period to date.



RATIOS OF OPERATING COSTS

ITEMS	MONTH OF						PERIOD TO DATE					
	AMOUNT	AMOUNT	AMOUNT	PERCENT TO TOTAL			AMOUNT	AMOUNT	AMOUNT	PERCENT TO TOTAL		
DIRECT COST												
MATERIALS		5840 00		25 2								
DIRECT LABOR		7550 00		32 5								
TOTAL DIRECT COST			13390 00		57 7							
INDIRECT COST -												
MANUFACTURING EXPENSE -												
LABOR & SALARIES		6406 00		27 5								
MISCEL EXPENSES	3227 00											
LESS -												
CHARGES TO ASSETS	739 19											
SHARE OFFICE TO SELL	363 51											
PACK & SHIP TO SELL	508 39											
PAT ORDERS TO G I P	238 82											
TOTAL DEDUCTIONS	1849 91											
NET MISCEL EXPENSE		1377 09		5 9								
NET MANUF'G EXPENSE			7783 09		33 4							
TOTAL MANUF COST			21173 09			91.1						
SELLING EXPENSE												
GENERAL	1190 00											
SHARE OFFICE	363 51											
PACK & SHIP	508 39											
TOTAL SELL EXPENSE			2061 90	8 9	8 9	8 9						
TOTAL OPERATING COST			23234 99	100	100	100						

Form 60.

With such reports, an executive is placed in a position to analyze conditions intelligently, discuss them with his department heads and decide upon policies productive of greater economies in manufacturing and selling. Cost methods themselves will not produce profits. It is the use to which they are put which will bring the returns.

CHAPTER XIV

GATHERING THE FINAL COSTS

The information that a finished job, which was sold for $1,000, has cost $1,025.17 is of little value to a foundryman. It is of far greater importance to know whether the cost is running high or low as production progresses, so that immediate steps may be taken to stop the loss.

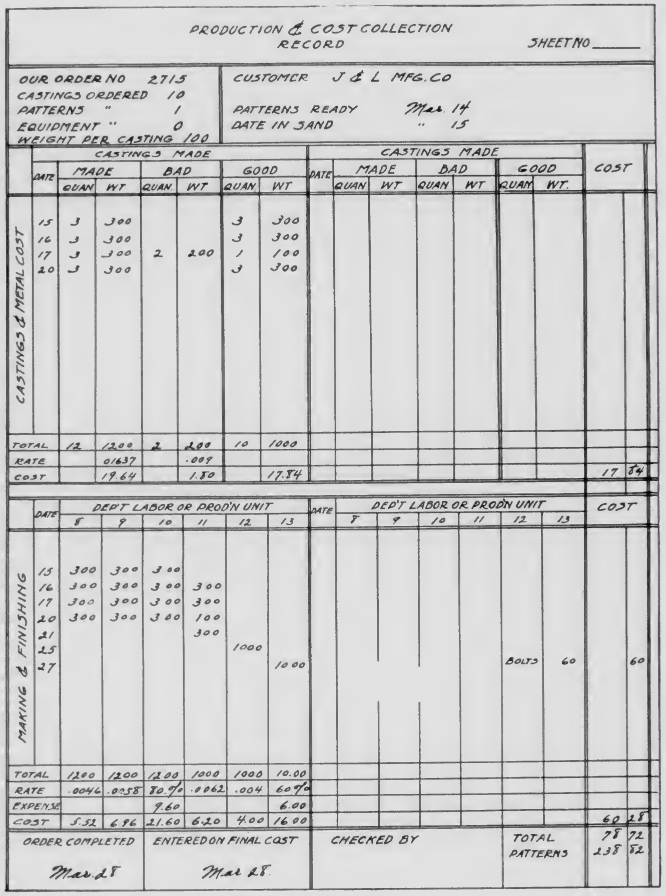
That is why, for a jobbing foundry, the job or order costs are gathered on a record similar to Form 61, which gathers the costs as the work progresses. With this record the cost department can check the costs frequently to determine whether they are running behind or ahead of the estimate.

148. Gathering the Cost of a Job.—The castings made, bad and good, are entered as produced so that losses may be controlled and overweights prevented. Similarly the core making, moulding, cleaning, etc., is followed. The cost is developed from the normal unit costs and the results shown are compared with the actual final cost as shown on Form 49.

The final normal cost—instead of the actual—is then ready for entry on the comparative cost summary, Form 50. The final cost record, Form 62, shows the cost by departments or operations as well as by material, labor and expense costs. The total manufacturing cost is shown with the selling expense, final cost, selling price and profit on the job.

Profit by orders or classification of product is a matter of considerable importance since it places the executive in a position to know where the profits are made and on what product the losses occur.

So much for the method of gathering the final costs by job or orders.



PRODUCTION & COST COLLECTION RECORD

SHEET NO ______

OUR ORDER NO 2715
CASTINGS ORDERED 10
PATTERNS " 1
EQUIPMENT " 0
WEIGHT PER CASTING 100

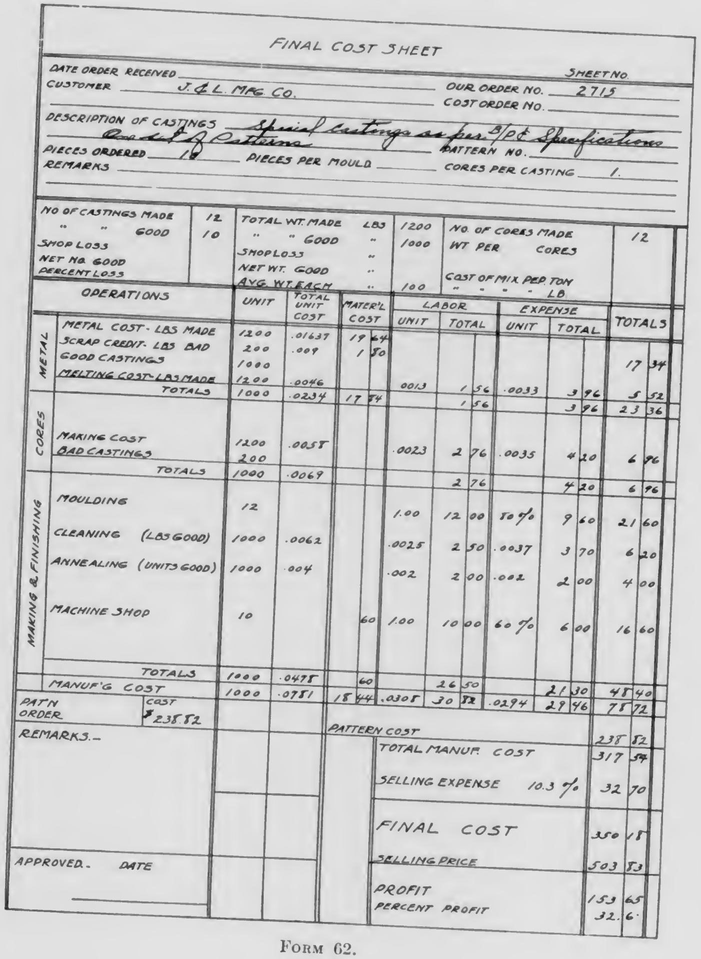
CUSTOMER J & L MFG. CO
PATTERNS READY Mar. 14
DATE IN SAND " 15

		CASTINGS MADE							CASTINGS MADE						COST
	DATE	MADE		BAD		GOOD		DATE	MADE		BAD		GOOD		
		QUAN	WT	QUAN	WT	QUAN	WT		QUAN	WT	QUAN	WT	QUAN	WT.	
CASTINGS & METAL COST	15	3	300			3	300								
	16	3	300			3	300								
	17	3	300	2	200	1	100								
	20	3	300			3	300								
TOTAL		12	1200	2	200	10	1000								
RATE			01637		.009										
COST			19.64		1.80		17.84								17 84

	DATE	DEP'T LABOR OR PROD'N UNIT						DATE	DEP'T LABOR OR PROD'N UNIT						COST
		8	9	10	11	12	13		8	9	10	11	12	13	
MAKING & FINISHING	15	300	300	3 00											
	16	300	300	3 00	300										
	17	300	300	3 00	300										
	20	300	300	3 00	100										
	21				300										
	25					1000									
	27						10 00						BOLTS	60	60
TOTAL		1200	1200	12 00	1000	1000	10.00								
RATE		.0046	.0058	80 %	.0062	.004	60 %								
EXPENSE				9.60			6.00								
COST		5.52	6.96	21.60	6.20	4.00	16.00								60 28

ORDER COMPLETED	ENTERED ON FINAL COST	CHECKED BY	TOTAL PATTERNS	78 72 238 82
Mar. 28	Mar 28.			

FORM 61.



FINAL COST SHEET

DATE ORDER RECEIVED
SHEET NO.
CUSTOMER J. & L. MFG. CO.
OUR ORDER NO. 2715
COST ORDER NO.
DESCRIPTION OF CASTINGS Special castings as per B/Pt Specifications
One set of Patterns
PIECES ORDERED 10
PIECES PER MOULD
PATTERN NO.
REMARKS
CORES PER CASTING 1.

NO OF CASTINGS MADE	12	TOTAL WT. MADE	LBS	1200	NO. OF CORES MADE	12
" " GOOD	10	" " GOOD	"	1000	WT PER CORES	
SHOP LOSS		SHOP LOSS	"			
NET NO. GOOD		NET WT. GOOD	"		COST OF MIX PER TON	
PERCENT LOSS		AVG. WT. EACH	"	100	" " " " LB	

	OPERATIONS	UNIT	TOTAL UNIT COST	MATER'L COST	LABOR UNIT	LABOR TOTAL	EXPENSE UNIT	EXPENSE TOTAL	TOTALS
METAL	METAL COST - LBS MADE	1200	.01637	19 64					
	SCRAP CREDIT - LBS BAD	200	.009	1 80					
	GOOD CASTINGS	1000							17 84
	MELTING COST - LBS MADE	1200	.0046		.0013	1 56	.0033	3 96	5 52
	TOTALS	1000	.0234	17 84		1 56		3 96	23 36
CORES	MAKING COST	1200	.0058		.0023	2 76	.0035	4 20	6 96
	BAD CASTINGS	200							
	TOTALS	1000	.0069			2 76		4 20	6 96
MAKING & FINISHING	MOULDING	12			1.00	12 00	80 %	9 60	21 60
	CLEANING (LBS GOOD)	1000	.0062		.0025	2 50	.0037	3 70	6 20
	ANNEALING (UNITS GOOD)	1000	.004		.002	2 00	.002	2 00	4 00
	MACHINE SHOP	10		60	1.00	10 00	60 %	6 00	16 60
	TOTALS	1000	.0478	60		26 50		21 30	48 40
	MANUF'G COST	1000	.0781	18 44	.0308	30 82	.0294	29 46	78 72

PAT'N ORDER — COST $238.82

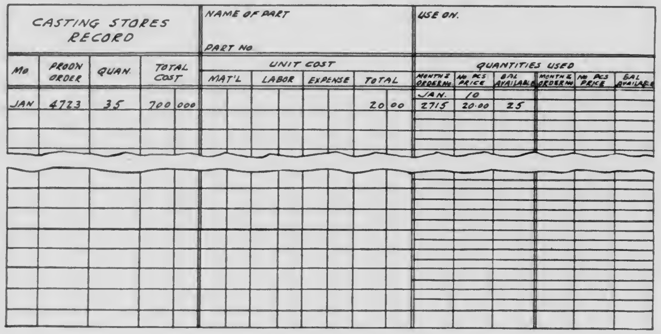
REMARKS.—

APPROVED.— DATE

PATTERN COST	238 82
TOTAL MANUF. COST	317 54
SELLING EXPENSE 10.3 %	32 70
FINAL COST	350 18
SELLING PRICE	503 83
PROFIT	153 65
PERCENT PROFIT	32.6

FORM 62.

149. Another Way to Gather Final Costs.—In another foundry the product made may be a highly repetitive one which flows continuously through all departments and is stored in finished form. Other conditions of manufacturing make necessary a casting stores department; for instance in the manufacture of stoves, heaters and boilers, the castings are issued from the stores department to the assembling or mounting department as demand requires.



CASTING STORES RECORD

NAME OF PART
PART NO
USE ON.

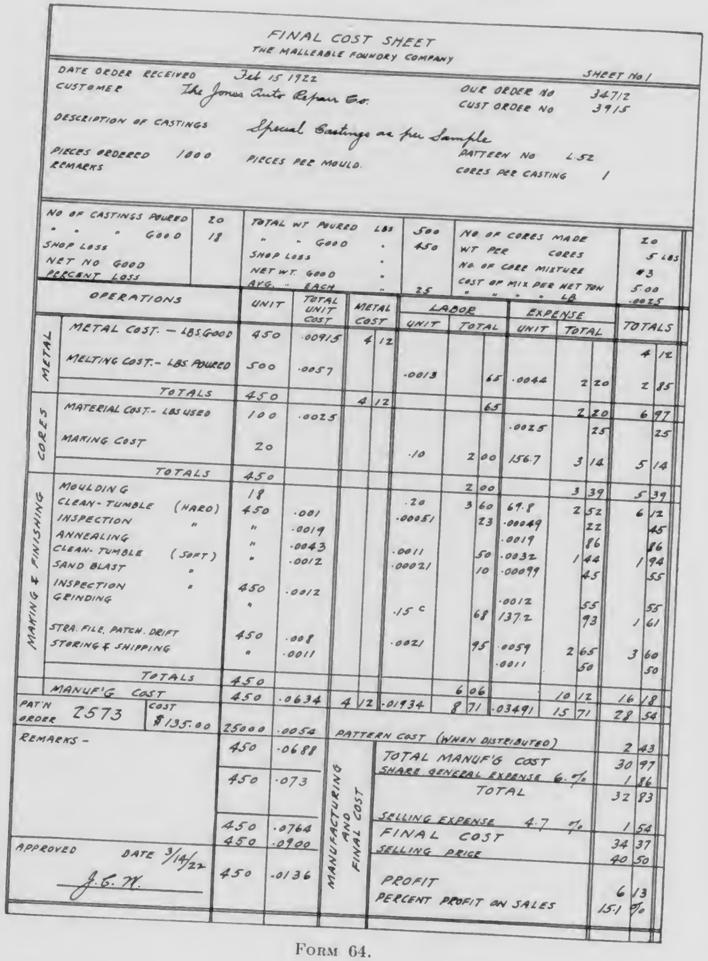
MO	PROD'N ORDER	QUAN.	TOTAL COST	UNIT COST MAT'L	UNIT COST LABOR	UNIT COST EXPENSE	UNIT COST TOTAL	QUANTITIES USED MONTH & ORDER NO	NO PCS PRICE	BAL AVAILABLE	MONTH & ORDER NO	NO PCS PRICE	BAL AVAILABLE
JAN	4723	35	700 000				20 00	JAN. 2715	10 20.00	25			

FORM 63.

This makes necessary the Casting Stores Record to provide for the inventory and quantity control together with the cost of each casting. Such a stores record is Form 63. The costs may be determined as a pound cost for the classification or total production, in which case it is advisable to follow up the individual performance of moulders in order to check losses, overweights, and the quality of castings by pieces or classification. If only the total cost be watched inefficient production in some departments may be buried in the lump figure.

Machine shop costs should be controlled by operations and parts for this reason.

150. How Detailed Should Costs Be?—Daily reports are of great value for checking performances and efficiency. The accuracy of the monthly results as shown by the expense analysis is assured if the daily checking is carefully followed up and the performances properly controlled.



FINAL COST SHEET
THE MALLEABLE FOUNDRY COMPANY

DATE ORDER RECEIVED Feb 15 1922 SHEET No 1
CUSTOMER The Jones Auto Repair Co. OUR ORDER NO 34712
CUST ORDER NO 3915
DESCRIPTION OF CASTINGS Special Castings as per Sample
PIECES ORDERED 1000 PIECES PER MOULD. PATTERN NO L.52
REMARKS CORES PER CASTING 1

NO OF CASTINGS POURED	20	TOTAL WT POURED LBS	500	NO OF CORES MADE	20
" " " GOOD	18	" " GOOD "	450	WT PER CORES	5 LBS
SHOP LOSS		SHOP LOSS "		NO. OF CORE MIXTURE	#3
NET NO GOOD		NET WT. GOOD "		COST OF MIX PER NET TON	5.00
PERCENT LOSS		AVG. " EACH "	25	" " " " LB	.0025

	OPERATIONS	UNIT	TOTAL UNIT COST	METAL COST	LABOR UNIT	LABOR TOTAL	EXPENSE UNIT	EXPENSE TOTAL	TOTALS
METAL	METAL COST. — LBS. GOOD	450	.00915	4 12					4 12
	MELTING COST.— LBS. POURED	500	.0057		.0013	65	.0044	2 20	2 85
	TOTALS	450		4 12		65		2 20	6 97
CORES	MATERIAL COST.— LBS USED	100	.0025				.0025	25	25
	MAKING COST	20			.10	2 00	156.7	3 14	5 14
	TOTALS	450				2 00		3 39	5 39
MAKING & FINISHING	MOULDING	18			.20	3 60	69.8	2 52	6 12
	CLEAN-TUMBLE (HARD)	450	.001		.00051	23	.00049	22	45
	INSPECTION "	"	.0019				.0019	86	86
	ANNEALING	"	.0043		.0011	50	.0032	1 44	1 94
	CLEAN-TUMBLE (SOFT)	"	.0012		.00021	10	.00099	45	55
	SAND BLAST "								
	INSPECTION "	450	.0012				.0012	55	55
	GRINDING	"			.15c	68	137.2	93	1 61
	STRA. FILE, PATCH. DRIFT	450	.008		.0021	95	.0059	2 65	3 60
	STORING & SHIPPING	"	.0011				.0011	50	50
	TOTALS	450				6 06		10 12	16 18
	MANUF'G COST	450	.0634	4 12	.01934	8 71	.03491	15 71	28 54

PAT'N ORDER 2573	COST $135.00	25000	.0054	PATTERN COST (WHEN DISTRIBUTED)	2 43
REMARKS —		450	.0688	TOTAL MANUF'G COST	30 97
		450	.073	SHARE GENERAL EXPENSE 6.%	1 86
				TOTAL	32 83
		450	.0764	SELLING EXPENSE 4.7 %	1 54
		450	.0900	FINAL COST	34 37
				SELLING PRICE	40 50
APPROVED J.C.W.	DATE 3/14/22	450	.0136	PROFIT	6 13
				PERCENT PROFIT ON SALES	15.1 %

MANUFACTURING AND FINAL COST

Form 64.

Good practical judgment is necessary to balance the detailing of cost against the effort required to get the detailed information. Most foundrymen overestimate the amount of clerical effort required. Therefore, detailed costs should not be decided against in advance through uninformed fear of red tape.

The total of the material, labor and expense as collected from the order or classification cost records must prove with the total of material, labor and expense in the general ledger accounts.

151. Final Cost of Malleable Castings.—In a malleable foundry the method of developing the final cost is, in principle, the same. The details vary only with the difference in the processing. Form 64 illustrates the final cost record for a jobbing order where a test cost has been taken with the first few castings. The unit costs are then taken from the expense analysis.

The initial cost differs from the method described in this book in that the return scrap is figured at the same price as the mixture. Consequently, there is no loss by difference in values of metal.

With the final figures on this form it will be noted that the cost per pound parallels the total cost in the column provided and shows the profit on the lot of castings.

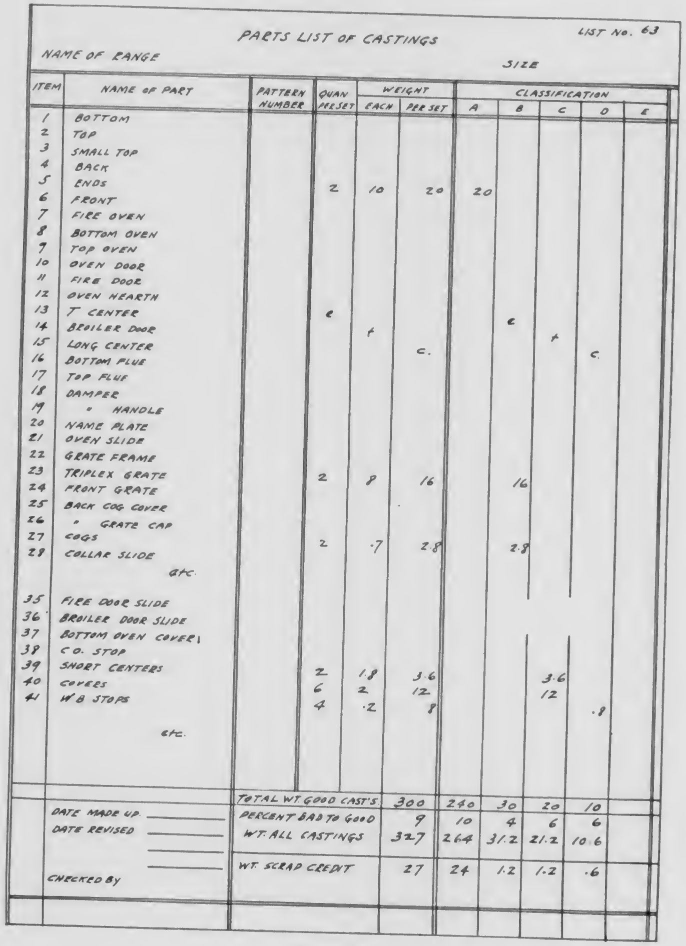
Attention is called to the fact that no loss percentages appear. This is because of the fact that such losses as were sustained were actually determined and the resulting expense charged into the departments. The unit costs as used, therefore, include such losses.

152. Final Costs in a Stove Foundry.—The manufacture of stoves, ranges, heaters and boilers, involves no change in the principles of costs. A change in the form of cost collection, however, becomes necessary with the change in the processes.

The forms needed for recording and developing the cost of a coal range are:

Form 65, the parts list of castings

Form 66, the purchased material and parts list, and

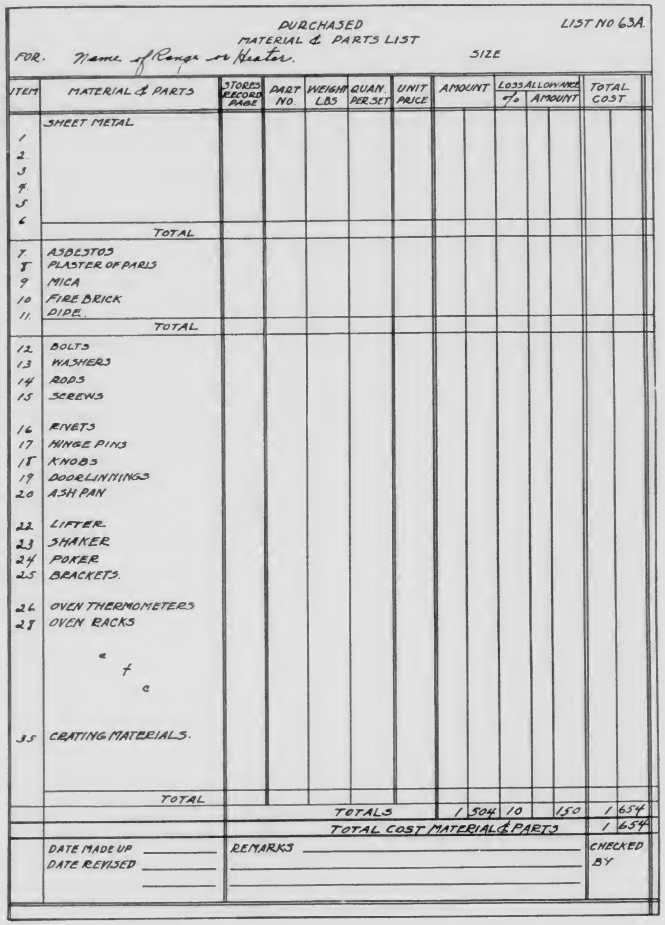


PARTS LIST OF CASTINGS — LIST No. 63

NAME OF RANGE — SIZE

ITEM	NAME OF PART	PATTERN NUMBER	QUAN PER SET	WEIGHT EACH	WEIGHT PER SET	CLASSIFICATION A	B	C	D	E
1	BOTTOM									
2	TOP									
3	SMALL TOP									
4	BACK									
5	ENDS		2	10	20	20				
6	FRONT									
7	FIRE OVEN									
8	BOTTOM OVEN									
9	TOP OVEN									
10	OVEN DOOR									
11	FIRE DOOR									
12	OVEN HEARTH									
13	T CENTER		e							
14	BROILER DOOR			t			e			
15	LONG CENTER				c.			t		
16	BOTTOM FLUE								c.	
17	TOP FLUE									
18	DAMPER									
19	" HANDLE									
20	NAME PLATE									
21	OVEN SLIDE									
22	GRATE FRAME									
23	TRIPLEX GRATE		2	8	16		16			
24	FRONT GRATE									
25	BACK COG COVER									
26	" GRATE CAP									
27	COGS		2	.7	2.8		2.8			
28	COLLAR SLIDE									
	etc.									
35	FIRE DOOR SLIDE									
36	BROILER DOOR SLIDE									
37	BOTTOM OVEN COVER									
38	C.O. STOP									
39	SHORT CENTERS		2	1.8	3.6			3.6		
40	COVERS		6	2	12			12		
41	W B STOPS		4	.2	8				.8	
	etc.									
	DATE MADE UP ______	TOTAL WT. GOOD CAST'S			300	240	30	20	10	
	DATE REVISED ______	PERCENT BAD TO GOOD			9	10	4	6	6	
	______	WT. ALL CASTINGS			327	264	31.2	21.2	10.6	
	______	WT. SCRAP CREDIT			27	24	1.2	1.2	.6	
	CHECKED BY									

Form 65.



PURCHASED MATERIAL & PARTS LIST — LIST NO 63A.

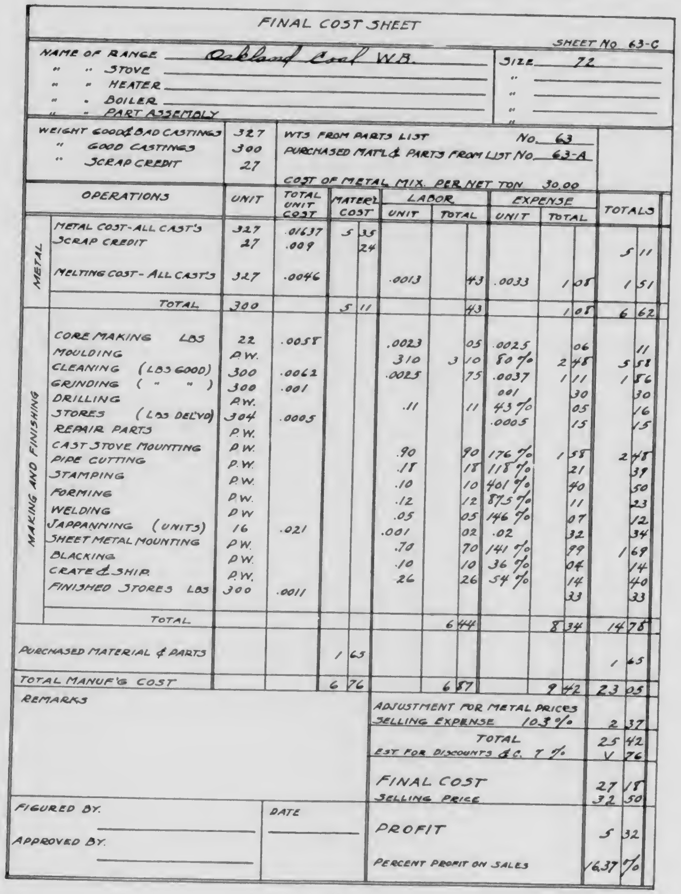
FOR. Name of Range or Heater. — SIZE

ITEM	MATERIAL & PARTS	STORES RECORD PAGE	PART NO.	WEIGHT LBS	QUAN. PER SET	UNIT PRICE	AMOUNT	LOSS ALLOWANCE %	LOSS ALLOWANCE AMOUNT	TOTAL COST
	SHEET METAL									
1										
2										
3										
4.										
5										
6										
	TOTAL									
7.	ASBESTOS									
8	PLASTER OF PARIS									
9	MICA									
10	FIRE BRICK									
11.	PIPE.									
	TOTAL									
12	BOLTS									
13	WASHERS									
14	RODS									
15	SCREWS									
16	RIVETS									
17	HINGE PINS									
18	KNOBS									
19	DOORLINNINGS									
20	ASH PAN									
22	LIFTER									
23	SHAKER									
24	POKER									
25	BRACKETS.									
26	OVEN THERMOMETERS									
28	OVEN RACKS									
	e t c									
35	CRATING MATERIALS.									
	TOTAL									
				TOTALS			1 504	10	150	1 654
				TOTAL COST MATERIAL & PARTS						1 654
	DATE MADE UP ______	REMARKS ______								CHECKED BY
	DATE REVISED ______	______								
	______	______								

Form 66.

Form 67, the final cost sheet.

Form 65 lists every pattern and casting which is used in making the complete range or heater. Even though a part is used on several ranges, it should be listed with each one.



FINAL COST SHEET

SHEET No 63-C

NAME OF RANGE Oakland Coal W.B. SIZE 72
" " STOVE
" " HEATER
" " BOILER
" " PART ASSEMBLY

WEIGHT GOOD & BAD CASTINGS 327
" GOOD CASTINGS 300
" SCRAP CREDIT 27

WTS FROM PARTS LIST No. 63
PURCHASED MAT'L & PARTS FROM LIST No. 63-A
COST OF METAL MIX. PER NET TON 30.00

	OPERATIONS	UNIT	TOTAL UNIT COST	MATER'L COST		LABOR UNIT	LABOR TOTAL		EXPENSE UNIT	EXPENSE TOTAL		TOTALS	
METAL	METAL COST-ALL CAST'S	327	.01637	5	35								
	SCRAP CREDIT	27	.009		24							5	11
	MELTING COST - ALL CAST'S	327	.0046			.0013		43	.0033	1	05	1	51
	TOTAL	300		5	11			43		1	05	6	62
MAKING AND FINISHING	CORE MAKING LBS	22	.0058			.0023		05	.0025		06		11
	MOULDING	P.W.				310	3	10	80 %	2	48	5	58
	CLEANING (LBS GOOD)	300	.0062			.0025		75	.0037	1	11	1	86
	GRINDING (" ")	300	.001						.001		30		30
	DRILLING	P.W.				.11		11	43 %		05		16
	STORES (LBS DEL'V'D)	304	.0005						.0005		15		15
	REPAIR PARTS	P.W.											
	CAST STOVE MOUNTING	P.W.				.90		90	176 %	1	58	2	48
	PIPE CUTTING	P.W.				.18		18	118 %		21		39
	STAMPING	P.W.				.10		10	401 %		40		50
	FORMING	P.W.				.12		12	875 %		11		23
	WELDING	P.W.				.05		05	146 %		07		12
	JAPPANNING (UNITS)	16	.021			.001		02	.02		32		34
	SHEET METAL MOUNTING	P.W.				.70		70	141 %		99	1	69
	BLACKING	P.W.				.10		10	36 %		04		14
	CRATE & SHIP.	P.W.				.26		26	54 %		14		40
	FINISHED STORES LBS	300	.0011								33		33
	TOTAL						6	44		8	34	14	78
PURCHASED MATERIAL & PARTS				1	65							1	65
TOTAL MANUF'G COST				6	76		6	87		9	42	23	05

REMARKS

ADJUSTMENT FOR METAL PRICES		
SELLING EXPENSE 10.3 %	2	37
TOTAL	25	42
EST FOR DISCOUNTS &C. 7 %	1	76
FINAL COST	27	18
SELLING PRICE	32	50
PROFIT	5	32
PERCENT PROFIT ON SALES	16.37	%

FIGURED BY. ______
APPROVED BY. ______
DATE ______

Form 67.

The weight of each set of castings is distributed to the columns provided for the classification of castings, in order to provide for the difference in cost of melting and metal due to varying percentages of loss. If the loss is greater on one class of castings than another, the melting cost is higher. The metal cost increases because of the greater difference in value due to return scrap. For instance:

Class A shows a 10 per cent loss. The unit cost is based on the good and bad castings, consequently the metal and melting cost is:

	Weight	Unit Cost	Total
Metal cost, all castings	264	$0.01637	$4.32
Scrap credit	24	0.009	0.22
Good castings	240	0.01708	4.10
Melting cost	264	0.0046	1.21
Good castings	240	$0.02217	$5.32

To use this same illustration with only a 2 per cent loss, the calculation is:

	Weight	Unit Cost	Total
Metal cost, all castings	245	$0.01637	$4.01
Scrap credit	5	0.009	0.05
Good castings	240	$0.0165	3.96
Melting cost	245	0.0046	1.13
Good castings	240	$0.0212	$5.09

In the first case the 240 pounds of good castings cost $5.32, while in the second the cost is $5.07, or approximately $0.001 a pound less.

153. Costs by Classifications.—These classification losses are especially valuable in determining the correct cost of repair parts. However, if it is certain that the variation in losses for the classes of castings in a foundry is exceptionally small, it may be possible to omit this part of the calculation.

For instance, it was assumed by the executives of one foundry that the losses on three types of castings were respectively, 5 per cent, 7 per cent and 10 per cent.

A careful analysis, however, showed the losses to be, 4 per cent, 10 per cent and 6 per cent. This made a marked difference in the metal and melting cost.

The weights from Form 65 which are used on the final cost sheet for the complete range or heater, are the totals only.

The classification details, as stated above, are used in making up the cost of parts for repairs and also in developing a parts casting cost for the castings stores record when one is used.

This is a permanent record, although it will need occasional revision to secure the highest degree of accuracy in weight and loss ratios. The actual losses should be checked against this record, since it serves as a standard of performance, so that increases or decreases may be kept well under control.

154. Costing the Purchased Parts.—The sheet metal and purchased parts which must be included in the total cost of the range or heater, must also be kept track of. Too frequently these parts and the material are figured from roughly prepared lists which lack permanency and therefore fail to afford proper control.

One of the most convenient ways to build up the cost of these parts is to set up a permanent bill of materials like Form 66, which is called the "purchased material and parts list." The details for the cost of each item should be recorded on the stores record. This form needs no explanation until we come to the set of columns headed "Less Allowances."

To build up a parts specification it is necessary to determine the exact requirements of each range, heater or boiler. It is a well known fact, however, that there is some waste and loss. For instance, 100 stove bolts may be required for a given quantity of a certain type of stove. The actual withdrawal from stock may, over a period, be 110—an increase of 10 per cent in the quantity and cost. This 10 per cent may then be added to the actual requirement as illustrated on the form, or the loss may be carried as an expense to the department and accounted for in the expense analysis.

Whichever way is used the amount of the loss must be accounted for in order to keep the balance of stores correct, and the cost must parallel this accounting, otherwise the inventory values will not be accurate.

Assuming that these losses are here accounted for by the use of percentages, the amount of each item is added and the result is the total cost as shown in the last column on the form.

155. Permanent Specification Records.—With these lists made up, two permanent specifications book records are established, Form 65, giving the weights of castings, and Form 66, the cost of all other parts. With the unit costs from the expense analysis and piece rates for the labor, we are ready to gather the final costs on Form 67.

The form is in general, sufficiently clear. Attention is, however, directed to that portion which gives the weights of metal and the parts lists from which the information is taken. Attention is further directed to the departmental cost and the division into material, labor and expense.

A representative list of departments is illustrated, but it is to be remembered that such a list may be different for every foundry.

The cost of the metal and melting for the range called "Oakland size 72," is seen to be $6.62.

The departments are listed in the order of manufacturing. The unit costs for these departments are entered opposite the department names so that the labor and expense costs, separately determined, may be totaled in the last column. The sum of all labor and expense items amounts to $14.78.

The next item is for purchased material and parts, the cost of which was determined on the parts list, Form 66. This cost is entered as one amount, the details having been accounted for on the parts list.

There are thus three divisions on the final cost sheet, namely: The metal cost, making and finshing labor and expense, and the purchased parts cost, which gives a total manufacturing cost of the range amounting to $23.05.

156. The Journal Entries.—The sum of manufacturing cost on all shipments made for the month is credited to the Goods Finished and in Process Account, and debited to the Cost of Goods Sold Account, as was explained in the preceding chapters.

Beyond the manufacturing cost is the selling expense which when added gives the final cost of the product exclusive of the estimate for discounts and other additions and deductions which may occur in the general accounting.

It having been determined from past records that these items amount to 7 per cent of the manufacturing and selling cost, this amount is added and the final cost is the next figure, $27.18.

157. Changes in Metal Costs.—The selling price is then entered and the profit on the product sold is recorded. It may be assumed, to illustrate, that all the cost items, during a period to follow, remain the same with the exception of Pig and Scrap. Pig and Scrap may have advanced in price. This would obviously change the whole final cost sheet. At the top of the form, however, is an item "cost of metal mix per net ton—$30. If metal prices advance so that the cost of the mixture per net ton becomes $33, the advance in the unit cost will be the same as the advance in the metal prices, or 10 per cent. This is based on the assumption that the price advances are in the same ratio for both pig iron and scrap. If the advance ratios differ the correct accounting must be made through the expense analysis in order to determine the correct unit cost.

When the correct unit determination is made, the difference may be made to the manufacturing cost through the item "Adjustment for metal prices." This adjustment is sometimes made following the final cost item. This will not, however, give the correct adjusted cost. To illustrate, let us refer to the preceding paragraphs where the manufacturing cost of the range, $23.05, was mentioned as the credit to the Goods Finished and In Process Account and the debit to the Cost of Goods Sold Account when the range is shipped.

158. Adjusting the Difference.—If we assume that the adjustment for the increase in metal cost is 10 per cent, the amount of the adjustment will be 10 per cent of $5.11 or $0.51, which when added to the original manufacturing cost will give a new total of $23.56. It is this *new* total—$23.56, which now becomes a credit to the Goods Finished and In Process Account instead of the $23.05. If the adjustment is not made at this point in the calculation, the balance in the Goods Finished and In Process Account cannot be correct. To illustrate this point the following calculation is given:

The amount for adjustment is $0.51. If the credit is made on the basis of the $23.05 cost it will leave $0.51 too much in the Goods Finished and In Process balance. Then if 20,000 ranges are sold during the year, the inventory balance in the Goods Finished and In Process Account will be too high by $10,200. To be correct the credit must be made on the same basis as the cost, the metal having been credited to the Pig and Scrap Account and charged into Process and Finished Stock at the new prices.

Many other forms of final cost records might be presented but they would differ only in detail. The illustrations given will suffice to show the application of the methods described in the preceding chapters.

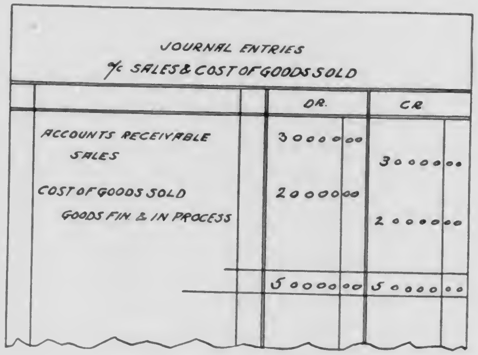
159. Calculating the Profit.—These final cost sheets have all shown the manufacturing cost, final cost and selling price. The next step is to apply the manufacturing cost to the sales which have been made during the month so that the manufacturing profit may be shown on the final statement.

As shipments are made and invoiced, a copy of each invoice should be sent to the cost department. By referring to the cost records the cost department should enter the manufacturing costs on the invoice opposite the sales price of each item. The sum of these costs deducted from the sales gives the manufacturing profit. When the selling expense is deducted the difference is the net income or profit from operations.

It is valuable to know the profit or loss for the month by classification of product. This may be by classes of castings for a grey iron jobbing foundry or malleable foundry. For a stove foundry the classification may be by gas ranges, coal ranges, stoves, heaters, boilers and so on.

This is accomplished by classifying the invoices and totaling the classification cost and sales.

The accounting for the total of all sales at the end of the month, using the figures set up on the chart of accounts, Form 2, Chapter 2, will be as shown in the accompanying illustration.



JOURNAL ENTRIES
% SALES & COST OF GOODS SOLD

			DR.		CR.	
	ACCOUNTS RECEIVABLE		30000	00		
	SALES				30000	00
	COST OF GOODS SOLD		20000	00		
	GOODS FIN. & IN PROCESS				20000	00
			50000	00	50000	00

FORM 68.

CHAPTER XV

THE FINAL STATEMENTS

With old methods of accounting the taking of the annual inventory was an event of great importance because at that time the books were closed and the results of the year's business determined. During the intervening months, little or no definite knowledge of operating conditions was available. Once a year was as often as most people wanted to make up a final statement, because it was too great a task to undertake at more frequent intervals. In some instances, however, a semi-annual inventory and closing of the books was the practice. Even then, the statements presented very meager information. The old methods are even today too commonly used. One reason for the colossal effort required in drawing up a statement under the old methods lay in the fact that not uncommonly 50 or more ledger accounts were required merely for the items of expense.

160. Eliminating Needless Accounts.—A definite control of operating conditions is exceedingly difficult with such a list of accounts. The general ledger should carry only the control accounts. The details which are nowadays properly shown by the expense analysis become a statistical guide for the purpose of directing the management toward greater economies. To wait until the close of the year to determine the results of operations is too long a period of uncertainty. They should be known at the end of each month.

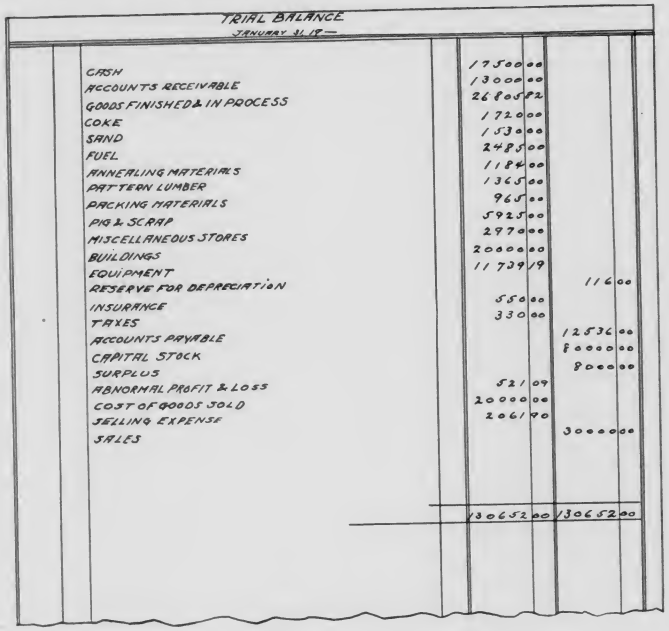
The details of control through the use of the expense analysis have been described in the preceding chapters. Proving the cost figures with the general accounts—a practice which has been introduced and successfully used by many of the more progressive foundries, has been emphasized. It therefore becomes possible, with little extra effort, to determine the condition of the business monthly. Occasionally a foundry man who is enamored of the possibilities offered by a modern cost system, tries to get a profit and loss statement weekly, but that is not to be recommended. A monthly statement is quite sufficient, when the machinery for checking the daily performances is followed. With frequent checking up, losses and waste are not likely to continue.

The proof of operations is to be found in the final statements, *i.e.*, the statements of condition and the statement of operations.

161. The Statement of Condition.—The statement of condition is a form on which are listed the assets and liabilities of the business. They are set up in parallel columns so as to disclose the net worth. This form is sometimes termed a balance sheet. It's purpose is to present facts so that the executive and Board of Directors may know where they stand. The statement of operations furnishes the details of such a statement and shows *how* the profits were made or why and where the losses occurred.

The statement of condition is today recognized for its real value to executives and has come into very general use. It discloses the net results of operations for the period, but in totals only. It gives no indications as to where or why profits were made or on what losses occurred. The statement of operations, however, is an analysis of the general totals and shows how the results of the period have been produced. It presents first the net sales, then the inventory of the Goods Finished and In Process at the beginning of the period with all additions to this account through direct material, and labor and the expense of doing business for the month. Deductions are made to the expense for any production which is to be capitalized and the net amount shows the inventory of the Goods Finished and in Process Account with additions and deductions for the month. The difference betwen this amount and the inventory of Goods Finished and in Process at the end of the month should check with the Cost of Goods Sold.

162. Building up the Statement.—The sales less the cost of goods sold becomes the manufacturing profit. The deduction of selling expense gives an amount representing the true trading profit. Accounting for other items of income and deduction, the final amount is the net profit for the month.



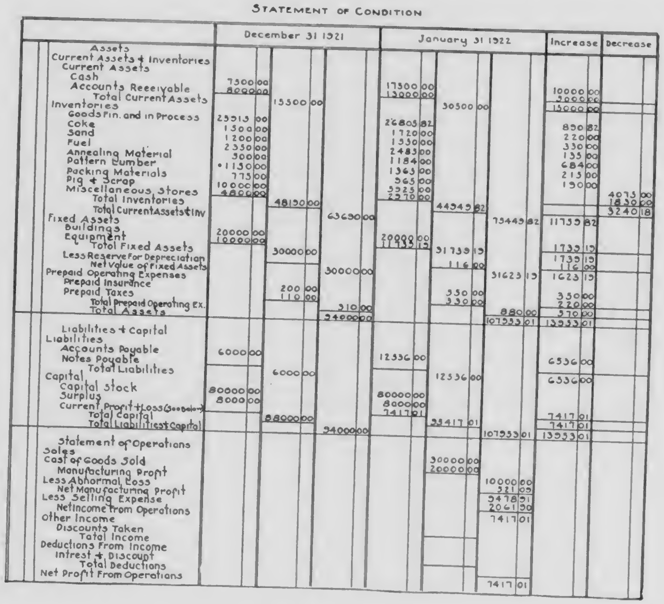
TRIAL BALANCE
JANUARY 31, 19—

CASH	17500 00	
ACCOUNTS RECEIVABLE	13000 00	
GOODS FINISHED & IN PROCESS	26805 82	
COKE	1720 00	
SAND	1530 00	
FUEL	2485 00	
ANNEALING MATERIALS	1184 00	
PATTERN LUMBER	1365 00	
PACKING MATERIALS	965 00	
PIG & SCRAP	5925 00	
MISCELLANEOUS STORES	2970 00	
BUILDINGS	20000 00	
EQUIPMENT	11739 19	
RESERVE FOR DEPRECIATION		116 00
INSURANCE	550 00	
TAXES	330 00	
ACCOUNTS PAYABLE		12536 00
CAPITAL STOCK		80000 00
SURPLUS		8000 00
ABNORMAL PROFIT & LOSS	521 09	
COST OF GOODS SOLD	20000 00	
SELLING EXPENSE	2061 90	
SALES		30000 00
	130652 00	130652 00

Form 69.

The statements shown in this chapter are all on a comparative basis, because standing alone, void of comparison with the other months or periods, they are much less valuable. It is the comparison of figures with former periods which shows the real success or failure and permits of intelligent deductions which will lead to improved policies of management.

163. The Trial Balance.—To develop the statement of condition, the first step is to take a trial balance of the ledger after all journal entries, described in the preceding chapter, have been made. This trial balance is shown on Form 69 with the accounts arranged in approximately the same order as they are listed on the statement of condition.



STATEMENT OF CONDITION

	December 31 1921			January 31 1922			Increase	Decrease
Assets								
Current Assets + Inventories								
Current Assets								
Cash	7500 00			17500 00			10000 00	
Accounts Receivable	8000 00			13000 00			5000 00	
Total Current Assets		15500 00			30500 00		15000 00	
Inventories								
Goods Fin. and in Process	25915 00			26805 82			890 82	
Coke	1500 00			1720 00			220 00	
Sand	1200 00			1530 00			330 00	
Fuel	2350 00			2485 00			135 00	
Annealing Material	500 00			1184 00			684 00	
Pattern Lumber	1150 00			1365 00			215 00	
Packing Materials	775 00			965 00			190 00	
Pig + Scrap	10000 00			5925 00				4075 00
Miscellaneous Stores	4800 00			2970 00				1830 00
Total Inventories		48190 00			44949 82			3240 18
Total Current Assets + Inv			63690 00			75449 82	11759 82	
Fixed Assets								
Buildings	20000 00			20000 00				
Equipment	10000 00			11739 19			1739 19	
Total Fixed Assets		30000 00			31739 19		1739 19	
Less Reserve for Depreciation					116 00		116 00	
Net Value of Fixed Assets			30000 00			31623 19	1623 19	
Prepaid Operating Expenses								
Prepaid Insurance		200 00			550 00		350 00	
Prepaid Taxes		110 00			330 00		220 00	
Total Prepaid Operating Ex.			310 00			880 00	570 00	
Total Assets			94000 00			107953 01	13953 01	
Liabilities + Capital								
Liabilities								
Accounts Payable	6000 00			12536 00			6536 00	
Notes Payable								
Total Liabilities		6000 00			12536 00		6536 00	
Capital								
Capital Stock	80000 00			80000 00				
Surplus	8000 00			8000 00				
Current Profit + Loss (See below)				7417 01			7417 01	
Total Capital		88000 00			95417 01		7417 01	
Total Liabilities + Capital			94000 00			107953 01	13953 01	
Statement of Operations								
Sales					30000 00			
Cost of Goods Sold					20000 00			
Manufacturing Profit						10000 00		
Less Abnormal Loss						521 09		
Net Manufacturing Profit						9478 91		
Less Selling Expense						2061 90		
Net Income from Operations						7417 01		
Other Income								
Discounts Taken								
Total Income								
Deductions from Income								
Intrest + Discount								
Total Deductions								
Net Profit from Operations						7417 01		

FORM 70.

A great deal of study has been given, by bankers, accountants and credit men, to the form which a statement of condition should take. Many arrangements have been tried, but the one shown on Form 70 has been generally accepted as being the most logical because of the clearness of the way it is developed.

This simple statement shows the results of the current month in comparison with the preceding month, with the resulting increases and decreases. It includes also the totals only for the statement of operation for the current month.

Several of the figures used in this statement may seem ridiculously out of proportion to those of any foundry business. Many accounts which are necessary to the conduct of a business do not appear. It has not been the purpose here to present all the accounts necessary because of the extended and unnecessary discussion which would be required. The object has been to simplify the illustration and present the method of cost accounting rather than a treatise on the details of general accounting. No attempt whatever has been made to give truly representative figures in any of these chapters. In fact, this has intentionally been avoided.

164. The Detailed Statement Is a Guide.—The statement of condition is analyzed to show first the current assets with inventories listed according to the accounts. These are followed by the fixed assets, prepaid operating expenses, and total assets, then the liabilities and capital.

The comparison of the two months in parallel makes it easy to determine the increases or decreases in each item of assets and liabilities. The total net increase or decrease is to be found in the Surplus Account, or as shown, the Current Profit and Loss. This is the profit or loss for the month and the balancing figure.

This same profit is also determined separately through the statement of operations and thus serves as a check or proof of accuracy. The statement of operations is shown as Form 71, and gives the current month figures in parallel with the period to date. This comparison is valuable in that it shows how the profits have developed over any number of months for the fiscal year as well as for the month just past.

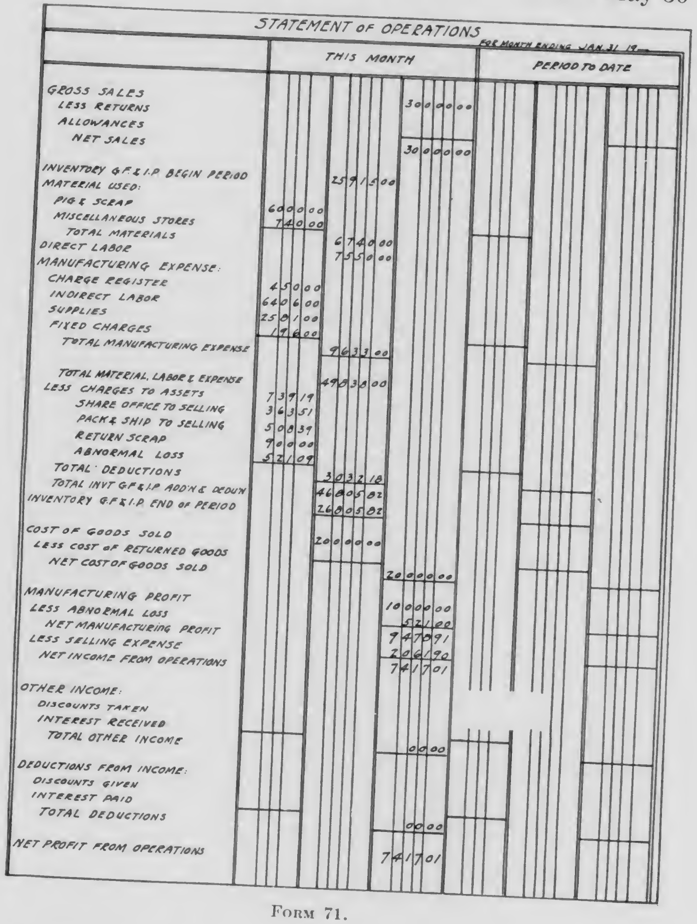
165. Another Arrangement of the Statement.—Another arrangement is to show the previous month, the period to date and the month just past. The heading for this presentation would be:

1922

For Month Ended April 30

For Four Months' Period Ended May 30

For Month Ended May 30



STATEMENT OF OPERATIONS

FOR MONTH ENDING JAN. 31 19—

	THIS MONTH			PERIOD TO DATE		
GROSS SALES			30000 00			
LESS RETURNS						
ALLOWANCES						
NET SALES			30000 00			
INVENTORY G.F. & I.P. BEGIN PERIOD		25915 00				
MATERIAL USED:						
PIG & SCRAP	6000 00					
MISCELLANEOUS STORES	740 00					
TOTAL MATERIALS		6740 00				
DIRECT LABOR		7550 00				
MANUFACTURING EXPENSE:						
CHARGE REGISTER	450 00					
INDIRECT LABOR	6406 00					
SUPPLIES	2581 00					
FIXED CHARGES	196 00					
TOTAL MANUFACTURING EXPENSE		9633 00				
TOTAL MATERIAL, LABOR & EXPENSE		49838 00				
LESS CHARGES TO ASSETS	739 19					
SHARE OFFICE TO SELLING	363 51					
PACK & SHIP TO SELLING	508 39					
RETURN SCRAP	900 00					
ABNORMAL LOSS	521 09					
TOTAL DEDUCTIONS		3032 18				
TOTAL INVT G.F. & I.P. ADD'N & DEDU'N		46805 82				
INVENTORY G.F. & I.P. END OF PERIOD		26805 82				
COST OF GOODS SOLD		20000 00				
LESS COST OF RETURNED GOODS						
NET COST OF GOODS SOLD			20000 00			
MANUFACTURING PROFIT			10000 00			
LESS ABNORMAL LOSS			521 00			
NET MANUFACTURING PROFIT			9478 91			
LESS SELLING EXPENSE			2061 90			
NET INCOME FROM OPERATIONS			7417 01			
OTHER INCOME:						
DISCOUNTS TAKEN						
INTEREST RECEIVED						
TOTAL OTHER INCOME			00 00			
DEDUCTIONS FROM INCOME:						
DISCOUNTS GIVEN						
INTEREST PAID						
TOTAL DEDUCTIONS			00 00			
NET PROFIT FROM OPERATIONS			7417 01			

FORM 71.

Preparing the statement of operations very logically turns our attention to the preceding chapters where it has been clearly shown how each item of material, labor and expense, has been accounted for.

Such a statement might be prepared by actually taking inventories but this would make a burdensome task for most foundries and might just as well be avoided. Once a year is sufficient for the purpose of a check against the various inventory accounts. Even then, if conducted according to the records which have been introduced and described, the work becomes a much easier task as compared with the old methods of taking physical inventories.

166. Physical Inventory Is Not Needed.—The monthly physical inventory can be avoided by using the deduction method. Take, for instance, the account for Miscellaneous Stores. A perpetual inventory record is maintained and the ledger account shows the value of these stores in bulk. Whenever materials or supplies are issued they are reported to the cost department so that at the end of the month, the total issue may be accumulated and the value representing such issues or consumption becomes a credit to the account, thus leaving a new balance in dollars and cents.

When these materials and supplies are used and credited to the account from which taken, they go either to the product being made or the expense of doing business. There must, therefore, be accounts to which these items may be charged. For this purpose, the Goods Finished and In Process Account has been created to receive all direct charges and the Manufacturing Expense Account to receive all expense charges. The analysis, therefore, which is to be set up on the statement of operation must show these transactions.

Aside from the item of net sales, the month's business opened with balances in the various accounts, among which we will refer for the present only to the inventory accounts. Since the account of Goods Finished and In Process is the point of accumulation for all materials, labor and expense accounted for during the period, its inventory balance is the starting point. The next items show the consumption of the direct materials, and the money paid for direct labor.

Following, all the items of expense are listed so that the statement will show for what expenses money has been paid out. How the amounts of these items were determined has been thoroughly explained in the preceding chapters and they are as listed on the statement of operations.

167. Additions to Inventory.—All of these items show additions to the original inventory of Goods Finished and In Process. There are, however, deductions to be made for transfer charges and those items which must be charged to the asset accounts, the development of which has been clearly described in the preceding chapters. These credits are next listed and when deducted from the total expense charges, give the net amount of Manufacturing Expense to be added to the Goods Finished and In Process Account. Thus we arrive at the next item on the statement, "Total Inventory of Goods Finished and In Process with additions and deductions."

When the cost of goods sold for the month is credited to the Goods Finished and In Process Account, we have a new balance, "Inventory Goods Finished and In Process at End of Month." When this amount is deducted from the inventory at the beginning of the month plus additions and deductions, we arrive at the cost of goods sold.

If we then deduct the net Cost of Goods Sold from the Sales we will have determined the manufacturing profit, which is the next item on the statement. The loss due to abnormal conditions is then deducted and the net manufacturing profit determined.

168. The Cost of Selling.—It has cost money to market the product sold during the month. This expense is an addition to the cost of operations and is treated through the item of selling expense in the next deduction. This gives the net income or gross profit from operations, *i.e.*, the profit from manufacturing and selling the product.

There are however, other activities in every business, which affect the profits, and which should be separated from the manufacturing and selling; for instance, cash discounts

are taken or allowed and interest is received or paid.

169. Financial Operations.—They have no relation to manufacturing because they are the result of financial management. Interest is paid because money is borrowed and it is received because there is an excess of capital on deposit or invested. Neither of these items has any effect on manufacturing performances. Cash discounts are allowed as an inducement for the prompt return of money which was delivered or shipped in the form of the product

DETAILED OPERATING STATEMENT
SHOWING PROFIT OR LOSS BY CLASSIFICATIONS

	TOTALS		CLASSIFICATION OF PRODUCT SOLD					
			A	B	C	D	E	F
GROSS SALES		30000 00	5000 00	4000 00	7000 00	11500 00	2500 00	
LESS RETURNS & ALLOWANCES								
NET SALES		30000 00	5000 00	4000 00	7000 00	11500 00	2500 00	
COST OF GOODS SOLD								
INVENTORY G F & I P BEGIN'G PERIOD	25915 00							
ADDITIONS TO INVENTORY								
PIG & SCRAP	6000 00							
MISCELLANEOUS STORES	740 00							
DIRECT LABOR	7550 00							
MANUFACTURING EXPENSE								
CHARGE REGISTER	450 00							
INDIRECT LABOR	6406 00							
SUPPLIES	2581 00							
FIXED CHARGES	196 00							
TOTAL INVENTORY & ADDITIONS	49838 00							
DEDUCTIONS:								
CHARGES TO ASSETS	739 19							
SHARE OFFICE TO SELLING	363 51							
PACK & SHIP TO SELLING	508 39							
RETURN SCRAP	900 00							
ABNORMAL LOSS	521 00							
TOTAL DEDUCTIONS	3032 18							
TOTAL INVTY, ADDNS & DEDUNS	46805 82							
LESS INVENTORY G.F.&I.P END OF PERIOD	26805 82							
COST OF GOODS SOLD	20000 00							
LESS COST OF RETURNED GOODS								
NET COST OF GOODS SOLD		20000 00	3000 00	2000 00	3000 00	10200 00	1800 00	
MANUFACTURING PROFIT		10000 00	2000 00	2000 00	4000 00	1300 00	700 00	
LESS ABNORMAL LOSS		521 09	78 16	52 11	78 16	265 76	46 90	
NET MANUFACTURING PROFIT		9478 91	1921 84	1947 89	3921 84	1034 24	653 10	
LESS SELLING EXPENSE		2061 90	265 27	224 23	385 42	1066 72	120 26	
NET PROFIT FROM OPERATIONS		7417 01	1656 57	1723 66	3536 42		532 84	
LOSS FROM OPERATIONS						32 48		

(DETAILED FIGURES SHOWING THE PROPORTION OF THE ITEMS IN FIRST COLUMN ARE SHOWN IN THESE COLUMNS IF SO DESIRED BY EXECUTIVES)

FORM 72.

made. Discounts are taken on purchases to conserve capital. The income and deductions from these transactions are next entered on the statement and are added to or subtracted from the trading profit and the result is the final net profit from operations. This amount agrees with the profit or additions to Surplus in the statement of condition.

170. Profit and Loss by Lines.—These statements account for the business as a whole, but it is not yet known whether there are losses on some lines of product and excessive profits on others. It may be that some lines are sufficiently profitable to be able to carry the losses of other lines. The obvious questions become, "Which of my lines are profitable and which show losses?" "How am I to determine this?"

It needs but a short time each month to assort the invoices, on which the cost has been extended by classes of product. It is then easy to prepare a detailed statement of operations, similar to Form 72. The first set of columns shows the total for the month in check with the first statement Form 71. The classes or lines of the product are then listed in the columns to the right. The total of the sales by lines as well as the cost of each line must check with the totals as shown for all lines of the business as a whole. The details or the intermediate items have been omitted but may be entered if desired.

An examination of this statement shows that Class D shows a loss while the other classes show reasonable profits. It may, many times, show that this condition is much worse, which when discovered, would call for a further analysis of the details of manufacturing to learn what is wrong.

171. General Summary.—Having completed the detailed description of a general method for accurate cost finding, let us review briefly the steps taken.

To recapitulate:

1. We start with an inventory.
2. We add to the inventory accounts by purchasing.
3. We use materials which go direct to the product (Goods in Process).

4. We use supplies or expense materials which are a part of the overhead (Manufacturing Expense).
5. We account for all labor as—
    (*a*) Productive—to the product (Goods in Process).
    (*b*) Non-productive—to overhead (Manufacturing Expense).
6. We have thus developed two accounts:
    "*Goods in Process*" including all items of labor and material chargeable direct to the product; and
    "*Manufacturing Expense.*" The overhead or the indirect expense necessary to produce the product.
    We have manufactured to produce, and the expense has gone in just two directions, namely—
    To the product, or
    To the expense necessary to make it.
7. The manufacturing expense has been analyzed in detail in the expense analysis.
8. Through this analysis we gain the necessary control of the business, and we determine a basis for figuring the cost of the product.
9. We cost our product:
    When sold, we credit this cost to the "Goods in Process" account, *i.e.*, we pull out of the Goods in Process inventory, at cost, what has been sold. This is the "Cost of Goods Sold."
10. The expense analysis gives the details of Selling Expense.
    The addition of this expense to the manufacturing cost gives the *final cost* of the product.
11. The product is sold.
12. The cost of goods sold against the sales gives the operating profit or loss.
13. With the closing of the books these facts are further detailed in:
    The summary of Expense Analysis.
    Tying the costs in with the general books.
    The trial balance.
    The statement of conditions, and
    The statement of operations.

These statements are the last use of cost figures. Throughout this discussion we have tried, not only to describe correct costing methods, but to emphasize the use to which the reports and figures should be put.

172. You Must Use Your Costs.—It seems trite—but experience has proved the need—to say that cost accounting left to itself will not make profits for you. Yet some men seem to feel that it will. If you have a good cost system, don't be satisfied merely with gathering the cost figures—study them and use them to guide your policies and to increase the efficiency of your plant and hence your profits.

It costs something—not much—but something, to run a cost system. If you are not willing to spend a little time studying and applying the figures it gives you, throw it out the window and stop the expense. But if it *is* a good system, fitted to your needs, and if you *really* use it, it will show you how to make many times as much money as it costs.

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Date Due

~~Sept 18~~
Mar. 31
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